



MERGERS AND THE COMPETITIVE PROCESS

by

John R. Baldwin<sup>1</sup> and Paul K. Gorecki<sup>2</sup>

No. 23E

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## ABSTRACT

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## ABSTRACT

This paper uses a longitudinal data base of establishments and firms taken from the Canadian Census of Manufactures to measure the intensity of mergers and to compare them to other change that leads to firm turnover. The importance of mergers is placed in the context of the plant and firm turnover process by comparing the amount of each merger type to alternate forms of expansion. Horizontal merger activity is compared to the creation of new plants by continuing firms. Entry by diversification is compared to entry by plant birth.

The paper then investigates post-merger success by examining market share, productivity, and profitability changes. When the extent to which acquired plants are subsequently divested is used to evaluate success, this divestiture process is compared to the exit rate of newly built plants. When changes in post-merger market share are examined, a regression is used to examine whether merged plants act any differently than other plants. When post merger productivity and profitability changes are examined, they are compared to what is happening to other plants in the same industry. The paper finds that the merger process contributes an important part of firm turnover and that the merger process improves productivity and profitability.

**Keywords:** Merger, Firm Turnover, Diversification, Productivity, Profitability, Market Share

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## Introduction

In previous work (Baldwin and Gorecki, 1990b, 1990c), we have examined the dynamics of intra-industry growth and decline. Firm turnover transfers resources from losers to winners. The emergence of new firms causes some firms to exit and others to decline. Successful firms grow at the expense of the less efficient. It is this process that contributes to renewal and productivity growth (Baldwin and Gorecki, 1990d).

This paper examines the merger process in the manufacturing sector. Mergers also serve to transfer resources from one firm to another and compete with alternative methods of accomplishing these ends. In the case of horizontal mergers, assets are transferred between firms already in the industry. Horizontal mergers attract attention because of their potential anti-competitive consequences; but, they do not account for the majority of merger activity in the 1970s. Between 1971 and 1973, only 43 per cent of all mergers in the Canadian manufacturing sector were horizontal; only 30 per cent fell in this category for the period 1977 to 1979.<sup>1</sup> In the majority of cases studied here, the transfer of a plant from one firm to another resulted in a firm exiting or entering an industry. These are what are broadly classified as diversifying mergers.<sup>2</sup>

Other studies have tried to provide comprehensive evaluations of the merger process, focusing on the profitability, productivity, and the growth path of merged firms. (Mueller, 1980; Cowling et al., 1980; Ravenscraft and Scherer, 1987) This study has somewhat more modest objectives. It attempts to compare the merger process to other changes that affect industry dynamics.

A study of mergers is best placed in the context of the other changes -- entry, exit, growth and decline -- that renew industries. While some firms already in an industry merge in order to expand, others do so by building plants. While some firms wishing to enter an industry do so by acquiring plants, others enter by building new plant. Comparing the merger process to these alternatives serves to provide a framework within which the efficacy of the merger process can be better understood.

This paper does so with an establishment-based data file using the Canadian Census of Manufactures principle statistics. Other studies have focused on the firm and used data from company balance sheets. Unfortunately, balance sheet information on a firm is difficult to assign to a particular industry because balance sheets so often cover operations in a number of different industries. Therefore, industry-specific effects cannot be readily examined.<sup>3</sup> It is also difficult to deal with a wide range of mergers in these circumstances -- especially when part of an operation is spun off. Because balance sheet information is rarely provided except at an overall company level, the performance of the parts that are divested cannot be examined prior to the divestiture.



Another source of data for merger studies is provided by stock prices for the merged parties before and after the acquisition (Eckbo, 1986). While providing useful information, these so-called "event" studies suffer from several disadvantages. First, as is the case with studies that use balance sheet data, the stock market event studies measure financial performance. At this level, stock prices may change because of anticipated productivity gains associated with the production process, because of anticipated tax savings, and because of financial innovations.<sup>4</sup> One of the questions left unanswered by stock market event studies is whether the gains that arise from mergers are a result of "real" or "financial" effects (Caves, 1987; Scherer, 1988). Second, stock market data do not permit a very fine level of industry detail to be used in cross-industry analyses because quoted companies often have operations spanning more than one industry.

This study uses plant data from the Census of Manufactures to measure the size and effects of mergers. It, therefore, allows the assignment of size and industry characteristics to be made relatively precisely. In using Census of Manufactures data, it focuses on the "real" side as opposed to the financial characteristics of merged firms. Because of its use of Census data that track the identity of firms and their plants over time, it promises to be more comprehensive than other studies that have to rely on identifying mergers from the financial press.<sup>5</sup> It has the disadvantage that it does not permit financial characteristics to be measured. In light of the recent debate on the meaning of balance sheet information,<sup>6</sup> this may not be a serious handicap.

Another difference between this study and others is the time horizon chosen. Other studies (Mueller, 1980) have focused on a short period before and after the merger. Accompanying papers (Baldwin and Gorecki, 1990b, 1990c) indicate why problems will develop with a research strategy that focuses only on the short run. In the short run, there is a large amount of transitory change. Shipments increase and decrease quite dramatically and it is difficult to distinguish trend movement from transitory change. Studies that focus on a short time before and after a merger suffer from not knowing whether the characteristics of a merged firm just before or just after the merger are a result of strictly cyclical phenomena. Longer-run studies are needed to establish trend.

In this study, both short- and long-run data are used. Most of the results are based on the latter, which are derived from a comparison of the status of plants and firms in 1970 and 1979. Choosing endpoints separated by several years and then measuring change using these years may not be the most powerful methodology, especially if relative plant and firm characteristics change rapidly. For the status (profitability, productivity) in the initial period of plants that are to be merged subsequently may not reflect status just before acquisition or what is more important, the status that was responsible for the merger; and status in the final year may not reflect the effects of the merger. On the other hand, short-run data have their deficiencies. If there is considerable variability in a firm's characteristics in the short-run and if most short-run change is transitory, short-run characteristics will only partially reflect structural change and no strong relationship between mergers and short-run characteristics should be found. To resolve this problem, the long-run data used here are analyzed in conjunction with information on short-run trends. Data on performance in the short run is used to both guide the longer-run analysis and to corroborate its findings.



There are other reasons for adopting the strategy that is used here. There is evidence to suggest that trends are slow to emerge and that there is enough persistence in profits and market share (Mueller, 1986) that the adoption of longer time horizons will provide the researcher with valuable information. Moreover, other work (Baldwin and Gorecki, 1990d), which examined the 1979 status of plants that entered between 1970 and 1979 and the 1970 status of plants that exited between 1970 and 1979, found significant productivity differences between entrants and exits and the rest of the population in each of these two years -- even though the exits were to occur over the next decade and the entrants as of 1979 could have been born any time during the preceding nine years. At least in this case, data in the year just prior to exit or just after entry were not required to show important differences between the plants that exited or entered and the rest of the population.

In evaluating the merger process, this paper first examines the importance of mergers relative to other changes that took place in the manufacturing firm population. It outlines the extent of turnover associated with both horizontal and diversifying mergers and compares it to the turnover that occurs because of the birth and death of plants. It investigates whether mergers affect the same part of the size distribution as do other forms of entry and expansion. It examines merger intensity by industry in order to determine whether mergers affect all industries equally. It explores the success of mergers by comparing the change in market shares of merged plants to other changes experienced by other plants in the population. It investigates the effect of mergers on changes in productivity and profitability.

## **The Importance of Mergers**

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### **a) Methodology Issues**

Comparisons of mergers to the rest of the ongoing firm turnover process can use long- or short-run, aggregate or disaggregate industry data. Measurement can focus either on firms or on establishments. Since the amount of measured merger activity can differ between studies because of differences in these factors and thus make comparisons difficult, two separate analyses are employed here. The first focuses on the short run and compares the yearly entry rate of firms that build new plants to those that acquire plants. Entry is defined to occur at the aggregate level of the manufacturing sector; that is, entrants are defined as firms that did not previously have a presence in the manufacturing sector. The second comparison shifts to a longer-run focus by comparing firms and their plants in 1970 and 1979. It uses a less aggregated industry level of definition. Entrants are defined as firms that are new to a 4-digit manufacturing industry. The 1970-79 data base allows the characteristics of different types of plants (entrants, exits, acquired) to be compared in these two years.

Throughout the analysis, the entry and exit of plants and establishments are defined by the appearance and disappearance of identifiers attached to producers. These identifiers allow plants and firms in the Census of Manufactures to be tracked over time. Because of the comprehensive nature of the Canadian census, these data potentially overcome the deficiency of earlier Canadian studies that have had to work with partial, non-random samples.

The existence of linked plant and firm identifiers alone does not guarantee that meaningful analysis can be performed. The identifiers may change for reasons that preclude research



into some topics. A detailed examination of this issue concluded that the identifiers could be used to analyze the entry and exit of plants and firms. Along with a description of the data bases and the methodology employed, this analysis can be found in Baldwin and Gorecki (1990a).

In the data base used here, a new plant identifier emerges when a new plant is created. Existing plants are reassigned identifiers only when the location, ownership, and name all change simultaneously. A greenfield entrant is defined in this study as the appearance of a new firm identifier in an industry associated with a new plant. An acquisition or merger entrant is defined in this study as the appearance of a new firm identifier in an industry associated with an existing plant. In the latter case, the firm has entered by acquiring assets -- and is referred to as acquisition or merger entry. The latter is a broad generic term used to describe a myriad of corporate changes -- as does the term merger. New firm identifiers are assigned when the firm is acquired by new controlling owners or when there is another major form of corporate reorganization. The change may involve just the purchase of a plant; it may involve the subsuming of one company into another; it may involve the integration of two corporate entities into a completely new one. For the purposes of this study, these various forms of control changes are not distinguished.

#### **b) Short Run Estimates of the Merger Entry**

Short-run rates of enterprise entry and exit to the manufacturing sector as a whole,<sup>7</sup> defined both in terms of number of firms and employment affected, are presented in Table 1. Rates of entry by plant creation (greenfield entry) and by acquisition of plants are tabulated separately. So too are rates of exit by plant closure (closedown exit) and by plant divestiture.

Over the period from 1970 to 1982, the annual greenfield entry rate averaged 4.3 per cent of the firm population being examined;<sup>8</sup> the annual entry rate via acquisition averaged only 0.6 per cent. However, the average size of a new firm that was created via acquisition was larger than that of a greenfield entrant. As a result, the employment entry rates for the two categories were quite similar.<sup>9</sup> Greenfield firm entry averaged 0.9 per cent and firm entry via acquisition averaged 1.1 per cent of total employment per year.

A similar picture emerges on the exit side. Closedown firm exit rates by plant closing are several times those of exit rates by plant divestiture -- 5.3 and 1.2 per cent of the firm population respectively over the period from 1970 to 1982. However, firm exit rates by divestiture averaged 2.0 per cent versus 1.2 per cent by plant closing when employment is used to measure the intensity of the processes.

While the average level of acquisition entry and divestiture exit, defined at the aggregate manufacturing level, is more important than entry via plant creation or exit via plant closure in terms of jobs affected, its importance varies substantially over time. In Figure 1, the percentage of jobs affected by divestiture exit is plotted along with the percentage of all firms that exited. Although divestiture exit affected 53 per cent on average of all jobs in exiting firms, this figure varied from less than 20 per cent to almost 80 per cent. Acquisitions come in erratically timed waves. This means that comparisons of the relative importance of

entry via plant creation and via acquisition may well be expected to differ across time periods because of variations in the type and intensity of merger waves in each time period.

### c) The Transition from Short to Long Run

In order to characterize the experience of surviving entrants in the 1970s, the data on entry to and exit from the manufacturing sector as a whole were used to calculate the share of each entry cohort as it matured. Data for each entry cohort from 1971 to 1980 were used and the average share, in terms of value-added, was calculated for each age class of each entry cohort. The results are plotted in Figure 2 both for greenfield entrants and for acquisition entrants. All shares are expressed in index form as a percentage of the share as of the year of birth.

Because there is immediate exit from each entry cohort, the average percentage of all firms accounted for by each entry cohort declines continuously as the cohort ages. This is the case for both forms of entry. In contrast, the average value-added share of the two forms of entry follows a very different path. Both initially increase; but while that of greenfield entrants continues to grow, that of acquisition entrants grows initially and then begins to decline. After 5 years, it has fallen below its initial level.

The growth rate of surviving greenfield entrants then more than offsets the high death rate experienced by each cohort in the early years of its existence. This is not the case for acquisition entrants. That the two groups of entrants do not experience the same post-entry success is not surprising in light of the differences between the two. Only greenfield entrants can be classified as true infants that have the potential for rapid growth towards maturation. Merger entrants are better characterized as mature firms looking for rejuvenation. Because of their larger initial size, there is less possibility for post-entry growth. Despite this, there is evidence of some initial success in the latter group after entry. To better appreciate the degree to which this is so, the normal path of market share for existing plants at any point in time is also plotted in Figure 2. It is just the 1 minus the share of entrants.

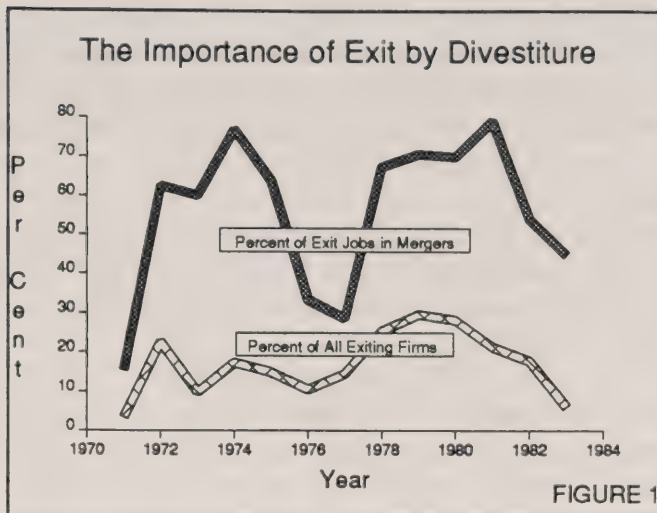


FIGURE 1

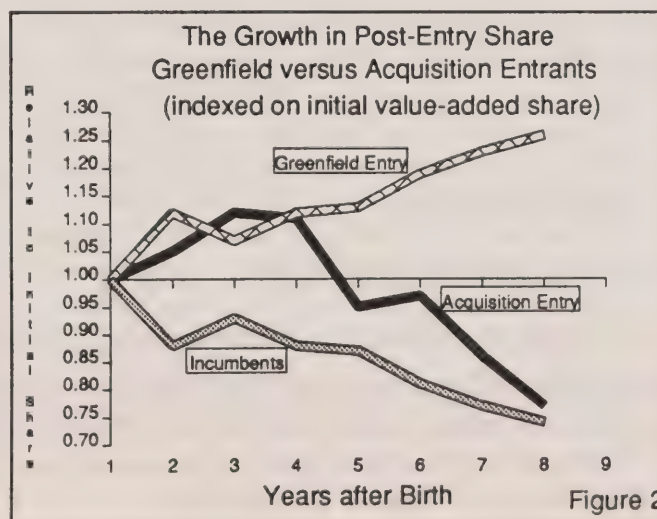
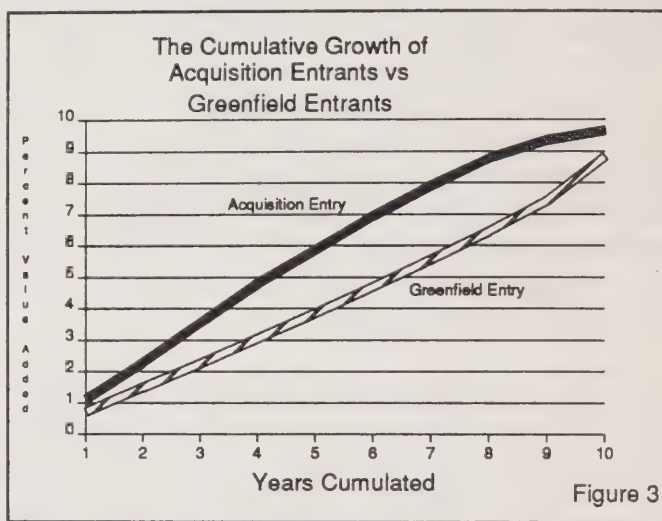


Figure 2



It is evident, then, that normally an incumbent would expect its share to decline continuously. By way of contrast, plants that have been merged experience a short-run increase in their market share before they follow the path they might otherwise expect to adopt because they are incumbents. Whether the merger effect is temporary or permanent depends on whether the eventual downward path causes market share to be lost at faster rate than incumbents might otherwise be expected to lose it. At the moment, there is insufficient data to determine whether this is the case. It does appear that the merged plants have just about returned to the normal growth path by the end of the period. Whether they pass below it and lose the short-run gains experienced to this point is another matter.

The cumulative effects of acquisition entry are plotted in Figure 3. The average market share, using value-added, of each entry cohort from 1970-71 to 1980-81 was used for the starting point. The average share trajectory corresponding to Figure 2 was then applied to each cohort. The resulting total market share captured by entrants is a representation of how the effect of entry accumulates on average. It is only a representation since the actual initial share varies over time -- especially for the case of acquisition of entry (see Figure 1).



Despite the reversal in the effects of acquisition entry after a short period, the cumulative effects of adding successive cohorts of acquisition entrants offsets this tendency for at least a decade.

In the case of greenfield entrants, the effect of entrants also cumulated inexorably over the first decade of measurement. Despite the high mortality rate for young greenfield entrants, the survivors grew at a sufficient rate to increase the overall share of a cohort, on average. Figure 3 also has the cumulative growth rate of successive cohorts of greenfield entrants superimposed on the cumulative growth path of acquisition entrants. Even though the paths of the average cohort depicted in Figure 2 for acquisition entrants and for greenfield entrants differ dramatically, the cumulative effects of both are remarkably similar over the first decade -- though there is some evidence to suggest that greenfield entrants will emerge in the lead in the second decade.

#### d) Cumulative Effects of Entry and Exit

- i) Using Measures of Entry to the Manufacturing Sector as a Whole.

Merged firms then experience a modicum of success -- one that is characterized by a short-run increase in market share. While a representation of the long-run cumulative effects of several cohorts of acquisition entrants was presented above, more precise measurement of these long-run effects is presented here.



Long-run entry rates are obtained first by comparing the status of firms and the plants they own, not in adjacent years as is done for the short run, but for two years that are further apart.

For comparison to the yearly short-run rates, the long-run rates can be expressed as a yearly annual equivalent.

In order to contrast the relative importance of greenfield entry and acquisition entry in the short and the long run, the status of manufacturing firms was compared in 1970 to 1976, in 1975 to 1981, and in 1970 to 1981. The cumulative rates of employment change for the two entry and the two exit categories are reported in Table 2. Entry and exit is defined at the level of the manufacturing sector as a whole.<sup>10</sup> Thus, for the period 1970-71 to 1980-81, the entry rate is calculated as the 1981 employment in manufacturing firms that were not in the manufacturing sector in 1970 divided by 1970 employment in the manufacturing sector. This measure captures the cumulative effect of all entrants to manufacturing from 1971 to 1981 that were extant in 1981.

The longer-run rates of entry and exit confirm the picture that was presented in Figure 3. When cumulated over periods of six to eleven years, merger entry and exit are processes of considerable magnitude and are approximately equal in effect to greenfield entry and exit. The 1981 employment in all firms entering during the period 1970-1 to 1980-1 was equal to 25.5 per cent of 1970 employment; for greenfield entry, it was 10.9 per cent; for entry by acquisition, it was 14.6 per cent. The same relationship holds for exit. Closedown exits over the period 1970-71 to 1980-81 accounted for 10.5 per cent of employment in 1970; exit via divestiture accounted for 17.7 per cent of 1970 employment.

- Measures of Entry at the 4-digit SIC level.

While the data for entry to the manufacturing sector as a whole show that decadal turnover is not insignificant, they may understate the importance of entry because they focus only on entry by firms outside the manufacturing sector. The previous analysis describes how the importance of entry accumulates inexorably; but it is based on averages and on a definition of entry to the manufacturing sector as a whole that may understate the amount of entry that occurs because it misses movement by a firm originally in one manufacturing industry to another. More comprehensive measures of the cumulative effect of entry were estimated at the 4-digit industry level are estimated in order to avoid the aggregation bias inherent in defining entry and exit to the manufacturing sector as a whole.

Detailed estimates of longer-run entry and exit rates were made using data that compare the status of plants in 1970 and 1979 and link plants to firms.<sup>11</sup> This data base permits the investigation of the importance of the categories presented in Chart 1. By measuring this process at the finer 4-digit industry level scheme using 1970 as the initial year and 1979 as the terminal year. The importance of the various cells of Chart 1 is presented in Table 3, first in terms of the proportion of the number of establishments involved, and second by the relative proportion of the new, acquired, divested, and closed plants' shares of industry shipments. In each case, the proportion is the mean taken across 167 4-digit industries.

The individual 4-digit industry level data presented in Table 3 confirm the importance of the entry and exit process that was found using turnover data for the manufacturing sector as a whole. The cumulative effect of entry and exit<sup>12</sup> over the decade of the 1970s was large.

In 1979, some 23.6 per cent of all establishments in a 4-digit industry on average were opened by firms that were created after 1970. Only 9.6 per cent of establishments in 1979 on average had been acquired by firms that entered by acquisition since 1970. On this basis, greenfield entry is more important than acquisition entry in the long run. However, when shipments are used, acquisition entry is only a little less important than greenfield entry. Establishments that were created since 1970 by new firms accounted for 15.0 per cent of shipments in 1979; but establishments that were acquired over the decade accounted for 11.8 per cent of shipments in 1979. Over the ten year period being used here, acquisition entry is less important relative to greenfield entry that it was in the short run. It is still, however, quantitatively significant.

### **e) Continuing Firms: Horizontal Mergers versus Plant Creation**

Differences between the alternative forms of expansion and contraction for continuing firms are just as interesting as differences in methods of entry. Continuing firms over the decade are those with a presence in both the opening and closing year. Turnover in the continuing sector is divided into two main categories. Continuing firms can expand their operations to new plants by either building (Chart 1, category 13) or in a horizontal merger by buying establishments (Chart 1, category 12). Continuing firms can reduce the number of plants operated either by closing plant (Chart 1, category 14) or divesting plant (Chart 1, category 11).

Table 3 shows that horizontal acquisitions are an important form of expansion for continuing firms. The share of 1979 industry shipments in plants acquired in horizontal mergers is about sixty per cent of shipments in newly-created plants in the continuing firm sector. Plants in these two categories accounted for 3.0 and 5.2 per cent of shipments on average in 1979, respectively.

While the horizontal merger process ranks large relative to the continuing firm new plant creation process, it is not as important as the acquisition process that brings new firms into an industry. Many fewer plants are acquired by continuing firms than by entering firms. The 1979 share of shipments in plants acquired by continuing firms is about one quarter that of plants acquired by entrants.

Nevertheless, the horizontal merger process plays a critical role in preventing existing firms from losing market share. Continuing firms expanded their market share on average by 4 percentage points from 69.1 to 73.2 per cent of shipments between 1970 and 1979 as Table 3 demonstrates. Some of this is generated because of the difference between the share of new plants in 1979 and closed plants in 1970 -- .6 of a percentage point. Some came from the internal expansion of continuing plants -- 1.6 percentage points. The remaining 1.9 percentage points came from the merger process.<sup>13</sup> This is considerably above the contribution made to expansion of continuing firms by the closure and opening of plants, or by the expansion of existing establishments.<sup>14</sup>



New participants in an industry are introduced in one of two different ways. On the one hand, new plants are created, either by new firms or by existing firms. On the other hand, existing plants are acquired by new firms and by existing firms. Whether it be new or continuing firms, over the decade of the 1970s the transfer of ownership was almost as important as the creation of new plants in terms of renewal. Any study of the importance of renewal for productivity growth and other aspects of industry performance needs to devote as much attention to mergers as to the plant birth and death process.

## **A Comparison of Merger and Alternative Activity**

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While takeovers are about as important a method of entry for new firms and expansion for existing firms as is the building of new plant, the merger process does not affect all industries or all groups of firms within industries equally. At the aggregate level of the manufacturing sector, the similarity in the relative importance of the two methods of expansion suggests they may be good substitutes. But upon a more detailed examination, substantial differences appear that show they are not perfect substitutes. Merger entry is concentrated in the largest size classes and in industries where entry barriers are higher. Entry by new plant creation decreases in importance as size class increases and is negatively related to concentration. The differences between the two forms of entry for new firms and the two methods of expansion for existing firms are examined below.

### **a) Size Class Differences**

- i) By method of entry

While the two methods of entry are of similar importance, they do not affect all size classes equally. When measured annually over the period from 1970 to 1984 at the level of the manufacturing sector as a whole,<sup>15</sup> the greenfield entrant had 20 employees on average upon entry; the acquisition entrant possessed 255 employees, on average, in its first year after take-over. Only 1.4 per cent of the former owned more than one plant; 17 per cent of the latter were multiplant firms. Exits present a similar picture. Firms that exited via plant closing possessed 26 employees on average at closedown; firms that exited by divestiture possessed 168 employees on average.

Entry via plant creation and via acquisition, therefore, affect different parts of the firm size distribution. Firm entry via plant creation and firm exit via plant closedown are concentrated in the smaller end of the size distribution. By way of contrast, failure at the upper end of the size distribution is less likely to result in death by plant closure; rather the market for corporate control overcomes the problem of failing management in larger firms and these firms are more likely to transfer plant to others than to close plant.

Differences in the intensity of the two forms of entry across different size classes were investigated using data that compared the status of plants and firms in 1970 and 1979 and used the 4-digit industry level of aggregation.<sup>16</sup> The degree of entry intensity for each form of entry and the total of the two are graphed in Figure 4 across 10 size classes. In order to generate the entry intensity measures, each industry was divided into 10 size classes by ranking all plants by share of shipments. Deciles were then used to group the plants into ten classes in ascending order of market share. Then entry intensity was calculated for each class



as the total number of plants in each entry category contained therein divided by total number of plants in each size class. Averages for each size class were then calculated across the 167 industry sample. This procedure was followed so as to reduce the industry aggregation bias that would result if the same size classes were used in each industry.<sup>17</sup>

In the smallest size class, entry by new plant creation accounts for over 20 per cent of plants; acquisition entry affects only 4 per cent. But the importance of firm entry by plant birth declines rapidly while acquisition entry increases, though not in a monotonic fashion, across size classes. Acquisition entry is just as or more important than entry by plant creation in the largest three size classes -- the classes that contain over 78 per cent of 1979 total employment.

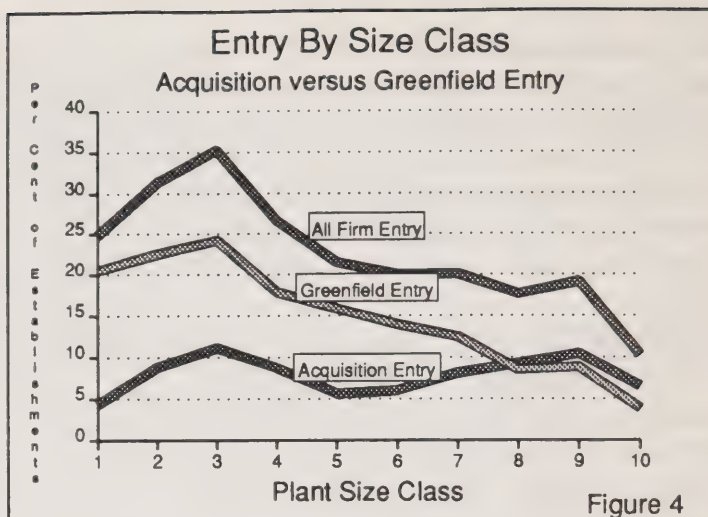


Figure 4

The same pattern is exhibited for the two methods of exit. Figure 5 plots the intensity of each form of exit across 10 size classes. The size classes are defined as previously and exit intensity is measured once again using the percentage of all plants in a particular exit category. In the smallest size class, 37.7 per cent of all plants in 1970 were closed because of firm exits by 1979; only 6.4 per cent of plants were divested by 1979 by exiting firms. But the top four size classes, which account for over 80 per cent of 1970 employment, have more firm exit by divestiture than by plant closure.

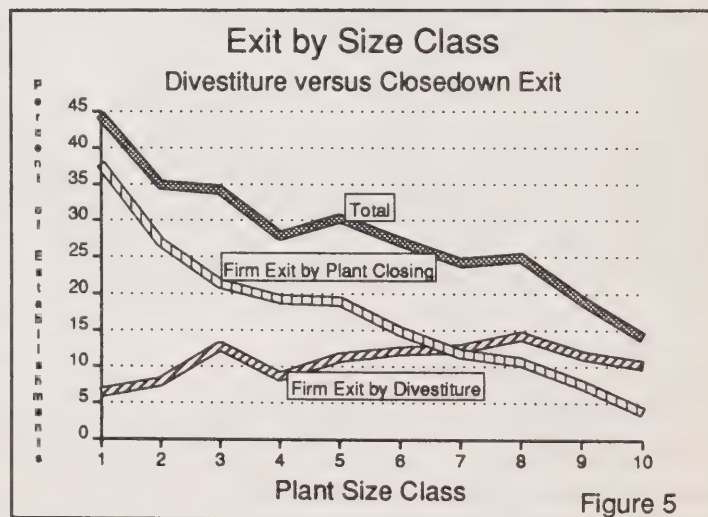


Figure 5

In conclusion, although entry by acquisition is about as important as entry by plant creation at the industry level, it is more important in the larger size classes. While firms that enter on a small scale by building plant may expand at a later date to rival the largest firms already in the industry, entry by acquisition immediately places the new firm in the upper cohorts. The plants of large firms are less likely to fail; they are more likely to be divested to another party.

- ii) By method of continuing firm expansion

Continuing firms can expand by building plant, by acquiring it, or by internal expansion of existing plants. The intensity of the alternate forms of expansion into new plants, using the share of establishments affected, is plotted in Figure 6 across plant size classes defined in the same way as Figures 4 and 5.

Horizontal mergers, like diversifying mergers, also become more important as size class increases. By way of contrast, new plant creation by continuing firms is not inversely related to size as was new firm new plant creation.

While there may be entry barriers that reduce plant creation by newcomers in the largest categories relative to the smallest, there appear to be few barriers to expansion by building

new plant. The intensity of continuing firm new plant creation is relatively constant across size classes when measured in terms of the share of establishments in this category. In the largest class, the two methods of continuing firm expansion (plant creation versus merger) are about equally important -- whether numbers of establishments or share of shipments is used.

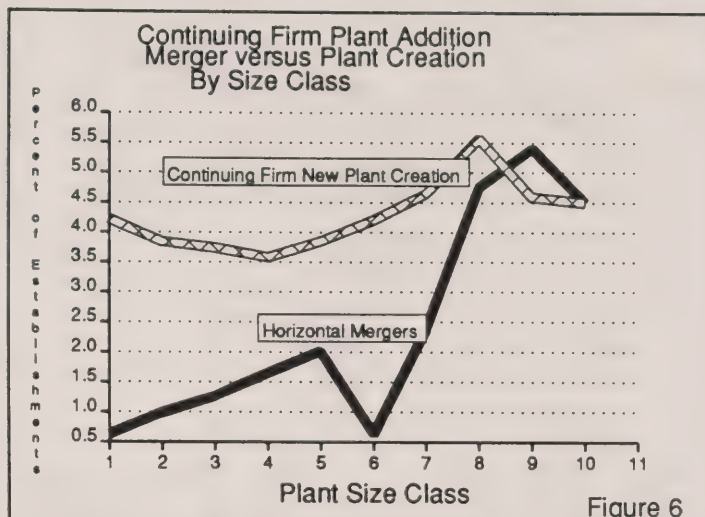


Figure 6

### b) Differences Across Industries

That mergers are concentrated in the larger size classes suggests that they are imperfect substitutes to the alternative form of entry or expansion via plant creation. They serve to facilitate entry where normally it is difficult because of the existence of scale economies. Since the distribution across size classes was calculated in the previous section in such a way as to avoid industry aggregation bias, this is not due to a particular concentration of takeovers in those industries that have larger firms. Nevertheless, it may be the case that acquisition entry is concentrated in some industries. If this is the case, the pattern of cross-industry differences may corroborate the reason for the size class differences.

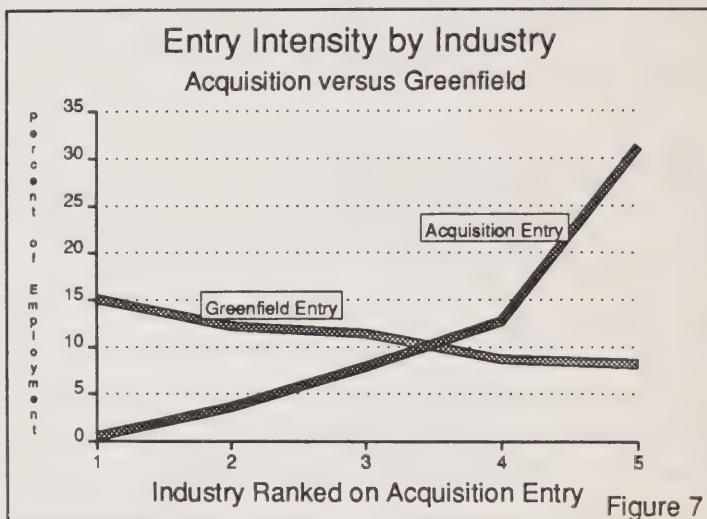
- i) Entry by Merger and by Plant Birth

A substantial component of the industrial organization literature stresses the connection between performance and entry barriers. Several applied studies have found that entry in Canada is inversely related to such barriers (i.e., Orr, 1974). The earlier studies did not test whether this phenomenon just affected entry by plant creation or also entry by acquisition because the data bases used did not allow for such distinctions to be made. But using data from the Canadian manufacturing sector that did permit such a distinction, Baldwin and Gorecki (1987) point out that acquisition entry is less affected by entry barriers than entry by new plant creation.



This suggests that entry by acquisition and by plant creation across manufacturing industries may be inversely related. This is the case. Across 167 4-digit industries, the rate of acquisition entry over the 1970-1979 period is inversely correlated with the rate of entry by new plant creation -- whether the rate is defined as the percentage of plants, the share of employment, or the share of shipments affected. For example, the correlation coefficient between the two, using share of 1979 employment affected, is  $-.18$  with significance level of  $.026$ .

The relationship between the two forms of entry is summarized in Figure 7, where intensity of acquisition entry is plotted against the intensity of entry by plant creation. Intensity is measured by the employment in the number of plants affected divided by total industry employment. Each of the 167 4-digit industries was ranked on the basis of acquisition intensity and then the industries were divided into five equal-sized groups. The means of acquisition entry intensity and the intensity of greenfield entry for each group are plotted in Figure 7 -- the five classes being ordered from left to right in terms of acquisition intensity. It is evident that entry by acquisition intensity increases in importance as the intensity of entry by plant creation decreases.



This comparison is two dimensional. It does not suggest the reason for the differences in the behaviour of the two series. In order to do so, use is made of multivariate regression analysis. An earlier paper (Baldwin and Gorecki, 1987) focused on the number of firms that entered and exited an industry between 1970 and 1979. That work is extended here to measure importance in terms of share of industry shipments accounted for by establishments in the two entry categories.

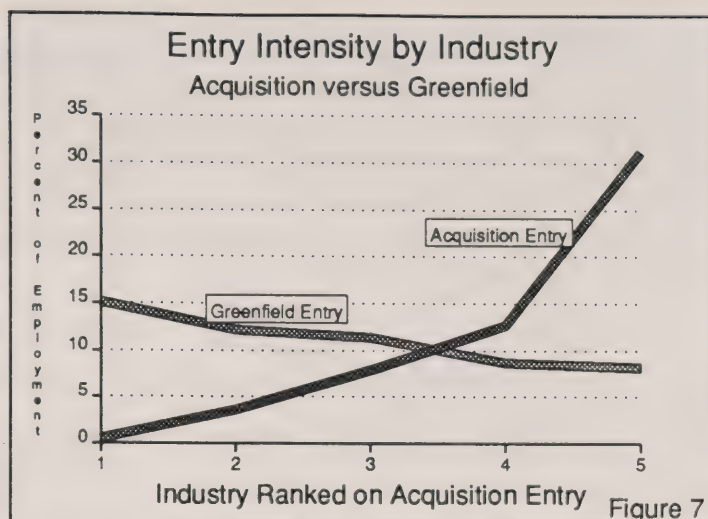
The data used for the regression analysis come from the 1970 and 1979 data base that was developed to examine long run entry and exit.<sup>18</sup> The dependent variables used are defined as

SH23 - the employment in new establishments (measured as of 1979) created between 1970 and 1979 by entering firms during the period, divided by total 1979 industry employment.

SH22 - the employment in establishments (measured as of 1979) acquired between 1970 and 1979 by firms that were not in the industry in 1970 but were in 1979, divided by total 1979 industry employment.



In earlier work (Baldwin and Gorecki, 1987), the effect of a large number of regressors was examined. The variables that were used fell into one of four groups -- those representing 1) growth 2) profitability 3) barriers to entry and 4) miscellaneous factors other than the standard entry barrier variables that described the openness of markets (such as trade penetration). A subset of the variables that were previously found to have had the strongest explanatory power was chosen for this analysis.<sup>19</sup> The definitions of the regressors used here can be found in Chart 2.



The first variable (GROW) is the rate of growth in industry shipments between 1970 and 1979. The second variable (PROFIT) measures profitability in 1970. It is an interaction term that captures both continuing firm profitability and the difference between large and small firm profitability. The third variable (PRFTGR) is a measure of profitability growth over the decade. These two profit variables are included to capture both the state of economic well-being in the early part of the period and changes therein during the period. If entry responds to well-being, the expected sign on each of the variables is positive.

A fourth variable (VAR) measures the variability in sales around the trend growth rate. An industry with a high value of VAR provides greater short-run temporary opportunities for new firms and, therefore, might also be associated with higher entry.<sup>20</sup>

The fifth variable (CON) is the 4-firm concentration ratio and is used to proxy entry barrier effects. In earlier work, several variables were included to catch various entry barriers; but for the purposes of this exercise, these various effects are grouped together with this proxy.

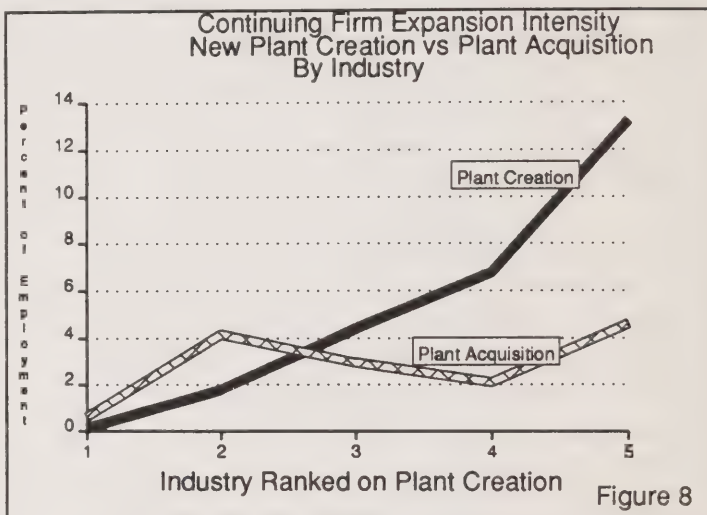
The regression results are reported in Table 4. The sample chosen for the analysis consisted of the 167 Canadian 4-digit manufacturing industries less some 26 industries that were classified as miscellaneous. Since the dependent variable is bounded by zero and one, a logistic transformation was performed<sup>21</sup> and an ordinary least squares technique was used.<sup>22</sup>

Greenfield entry and entry by acquisition react quite differently to these variables. The former responds significantly in a positive fashion to industry growth but not to the profitability variables. Acquisition entry is not significantly related to growth but is to changes in industry profitability. Greenfield entry is negatively related to concentration while acquisition entry is positively related to concentration. Finally, greenfield entry is higher in industries with greater volatility but acquisition entry is not.

In conclusion, acquisition entry is greater where entry barriers and profitability are high in general. These are industries where the alternate form of entry is either less or no greater than elsewhere. It is the merger process that brings new owners into those industries where greenfield entry is least likely and, therefore, least able to exert a competitive check on monopolistic power, if it exists. Whether acquisition serves the same equilibrating function often attributed to greenfield entry is another matter. Some aspects of the impact that merger entrants have are examined below.

- ii) Expansion by Horizontal Merger versus Plant Construction

Just as entrants have the alternative of building new plant or acquiring plant, continuing firms have the option of expansion via plant construction or by acquiring plant in the same industry. But here, the differences between the two processes are less marked. The intensity of horizontal merger and of continuing firm plant creation are positively, not negatively correlated, though the relationship is not significant. In Figure 8, the intensity of continuing firm plant creation is plotted against the intensity of horizontal acquisitions.<sup>23</sup> All 4-digit Canadian manufacturing industries are ranked on the basis of continuing firm new plant creation, grouped on the basis of quintiles, and ordered from left to right in Figure 8 in increasing importance of the intensity of plant creation. Horizontal merger activity in each quintile is then plotted using the same ordering system. It is apparent that there is little relationship between the two forms of plant expansion used by continuing firms.



Regression analysis was also used to examine the relationship between the intensity of each form of expansion by existing firms and certain industry characteristics. As in the case of the entry regressions reported previously, intensity was measured by share of industry employment accounted for by new and by acquired plants. Most industries -- around 95 per cent -- experience greenfield entry.<sup>24</sup> However, only 53 per cent of all 4-digit industries have horizontal acquisitions while only 77 per cent have plant creation by continuing firms. Therefore, in the case of continuing firm activity, two separate regressions were employed. The first uses a binary variable that takes on a value of 1 where there is plant creation or acquisitions and 0 where there is none. It is used to investigate the industry characteristics that are associated with some as opposed to no entry (the existence equation). The second regression uses the share of employment in plants created by continuing firms and acquired by continuing firms but only for industries where the share is greater than zero (the intensity equation). It is used to investigate the industry characteristics that are associated with increasing amounts of plant creation or acquisition by continuing firms where it exists. The



data come from the data base that compares plant and firm status in 1970 and 1979. The same variables that were used in the entry regressions were employed here. The results are contained in Table 5. The first two columns contain the estimated coefficients for the existence equations; the third and fourth columns contain the coefficients of the intensity equations.

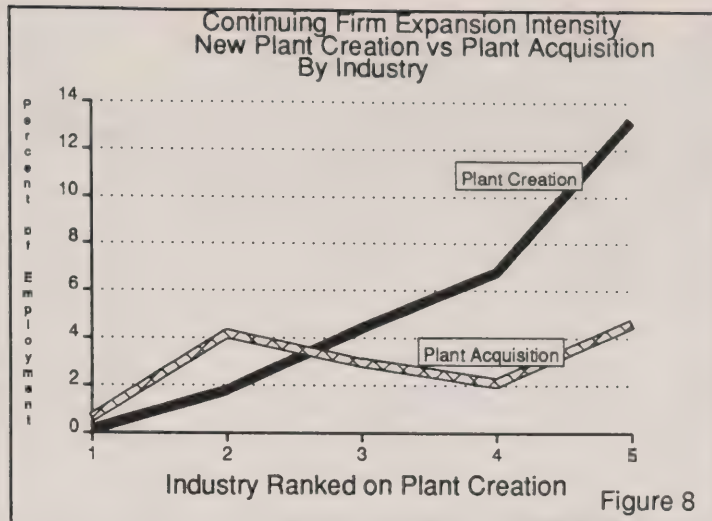
In the case of plant creation activity by continuing firms, the coefficients in both equations (Table 5, columns 1 and 3) were not very significant. The binary dependent variable equation shows that continuing firm plant creation occurs less frequently where variability in growth is higher. This is the same variable that was related to a greater intensity of entry by new plant creation. Continuing firm new plant creation was also more likely to be zero where profit growth was less. When the intensity of plant creation is used as the dependent variable (Table 5, column 3), only the concentration variable is at all significant and the associated coefficient is positive. It was negative for entry by plant creation. Thus high variability of the growth process and low concentration are associated with more new firm plant creation but less continuing firm plant creation.

In the case of horizontal merger activity, the binary existence variable is negatively related to concentration and profit growth. When the dependent variable measures the intensity of merger activity, output growth rate has a significant and negative coefficient.

The fact that both the existence and the intensity of horizontal mergers were negatively related either to output growth, or to growth in profitability suggests a rationalization process may be at work here. In earlier work (Baldwin and Gorecki, 1986), we reported that the number of horizontal mergers was significantly related to a variable that captured the extent to which the optimal number of plants was falling because of an increase in minimum efficient plant scale. The share equations used here also suggest a rationalization motive behind some mergers.

That the existence of horizontal mergers, but not their intensity, is negatively related to concentration may be ascribed to the Canadian competition law. While merger law was weak during this period, it may nevertheless have had a restraining effect in the most concentrated industries. On the other hand, that concentration did not affect merger intensity where mergers existed suggests, that below a certain threshold, mergers were related to a rationalization motive.

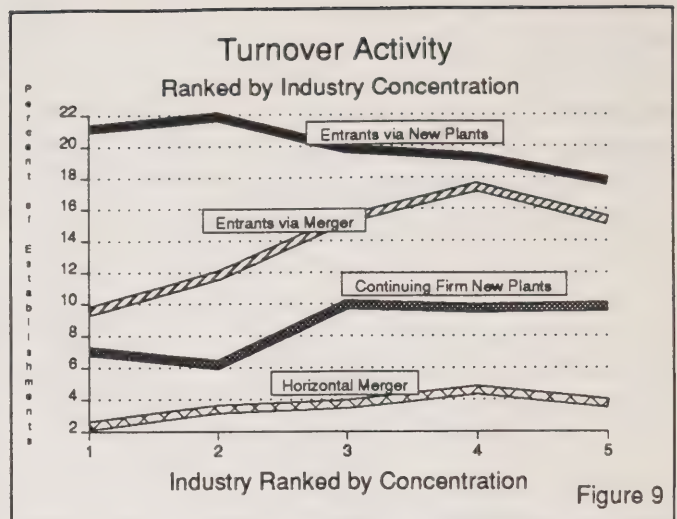
The one variable that most consistently appears in the various industry equations with a significant coefficient is concentration. The relationship between an industry's merger or



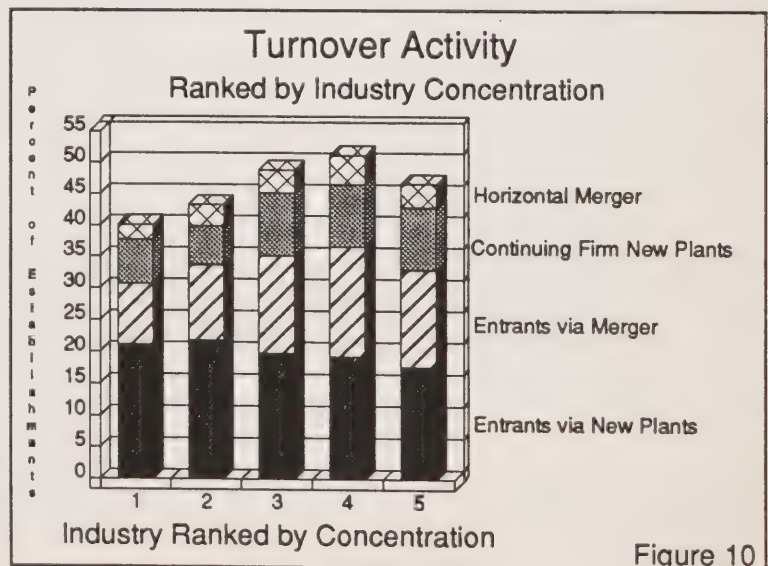


plant creation intensity and the industry level of concentration serves to clarify the differences in the various entry and expansion categories. This relationship between the two forms of entry and the two methods of continuing firm expansion, on the one hand, and industry concentration, on the other hand, is presented in Figure 9. In order to do so, all industries were ranked from lowest to highest concentration using the Herfindahl index. Then the 167 industry sample was divided into five groups using quintiles. The average entry and expansion intensities were calculated and then plotted for each quintile group where the quintiles are ranked from left to right in Figure 9 on the basis of increasing average concentration.

It is apparent that the intensity of continuing firm expansion by plant creation trends upwards with concentration. The intensity of both merger types does the same although the increase for the horizontal category is the least perceptible. That both forms of expansion by continuing firms tend to be higher in concentrated industries indicates that incumbents in these industries dominate plant turnover activity because entry by outsiders via new plant creation is less prevalent. Whether this reaction is sufficient to prevent disequilibria from leading to higher than normal profits is another matter.



It is striking that concentrated industries cannot be classified as static industries from the point of view of plant turnover, where turnover is defined as the percentage of plants in 1979 that were either newly created or acquired between 1970 and 1979. Concentrated industries may be protected from outside entry by new plant creation; but this is more than offset by increased activity by merger entrants, by horizontal merger activity, and by new plant creation by existing firms. In Figure 10, the total intensity of all four activities is plotted against concentration for the same five concentration classes used in Figure 10. As concentration increases, total turnover goes up -- except for the most concentrated class; nevertheless, it is still larger here than for the two classes with the



lowest levels of concentration.

### **Success as Measured by Survival and Market Share Change**

Much has been made of the fact that not all mergers succeed. Market share has been used as one criterion to measure success in some studies. The loss of market share is an indicator of, at best failure, and, at worst, the restriction of output associated with the monopolistic exploitation of markets. One extreme case of share loss is exhibited by those mergers that result in exit at a later date. In this case, market share falls to zero.

Market share considerations bear heavily in the literature that evaluates the success of mergers that diversify a firm from one industry to another. The Royal Commission on Corporate Concentration (1978) and work by Ravenscraft and Scherer (1987) have focused on the success of this group of mergers and use either the failure rate or post-merger market share to evaluate the success of mergers.<sup>25</sup> However, the use of market share decline or the use of the failure rate without reference to some control group or standard of comparison is misplaced. This section compares the failure rate of mergers with that of entrants and the market share changes of acquisition entrants with similar size plants that did not merge.

The failure of some mergers is to be expected. Entry by acquisition, by definition, involves entry to new markets. The progress of new firms that enter by building new plant has already been extensively examined in Baldwin and Gorecki (1990b). Greenfield entrants fail at very high rates during the early years of their existence. Less than half normally survive over the first decade. Takeover entry offers an alternative method of entry to an industry. It should not, therefore, be surprising if entry by merger also was less than completely successful. The interesting question is not whether some merger entry is unsuccessful or even whether it is, on average, unsuccessful; the important question is whether entry by merger is more or less successful than greenfield entry.

It is not just the exit rate of mergers that needs to be set in context of the general process of growth and decline. Some studies (Mueller, 1985) have focused on the post-merger performance of market shares. If post-merger market share changes are to be used to measure success, a standard of comparison is required. In a static world, a measure of success for a merger might be pre-merger market share. This would be inappropriate. The world is not static, and, therefore, another standard must be chosen. The appropriate standard of comparison for merger success is the growth and decline process that was previously outlined. In a world where firms are growing and declining, the plants involved in a merger might also be expected to grow and decline. If mergers were randomly distributed across size classes, maintenance of market share might also be a reasonable criterion. However, the previous section has demonstrated that mergers are not randomly distributed. They are concentrated in the larger size classes. In Baldwin and Gorecki(1990c), it was demonstrated that large firms tended to lose market share and small firms tended to gain it. Merged plants might then be reasonably expected to lose market share.

In this section, the change in market share of mergers is examined and compared to that which might have been expected. Whether it is larger or smaller than that experienced by comparably sized firms in the population is the relevant issue.



### a) Exit Rates for Mergers

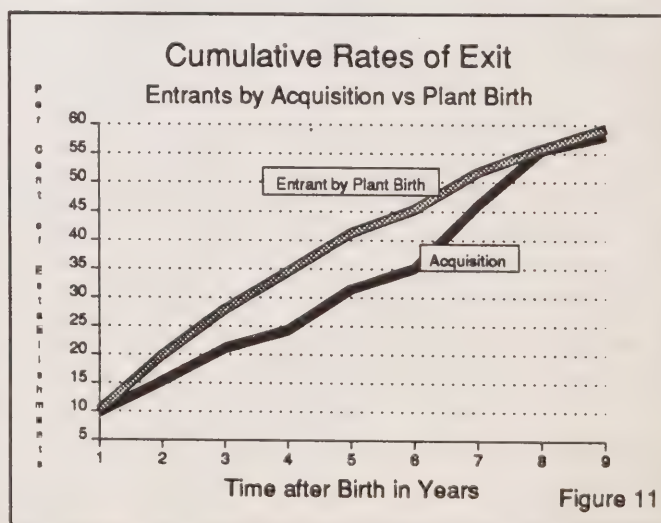
The most drastic downward adjustment in market share for an entrant occurs when it subsequently exits. The failure of a merger entrant to stay in an industry has been interpreted as an indication of the general lack of success of entry by merger. However, it was demonstrated earlier that alternative forms of entry are not guaranteed success. Firms that enter by building new plants fail. It is, therefore, useful to compare the two entry processes.

In order to do so, the annual data base that defines entry using the manufacturing sector as a whole was used.<sup>26</sup> Each acquisition entrant to the manufacturing sector between 1971 and 1980 was tracked subsequent to entry. The date of exit, if any, was noted. Then the experience of all entrants was summarized by year of entry for each of the two categories of entrants. The first are those that built plants; the second consists of those that acquired plants. The percentage of each entry cohort that exited in each subsequent year and the percentage that remained in the final year are presented in the Table 6.

The data confirm the findings of others that many of the firms entering an industry by merger exit at a later date. On average, 9 per cent of acquisition entrants exit within a year, 15 per cent within two years and 58 per cent by the end of nine years.<sup>27</sup> Entry by acquisition then is no guarantee that a firm will remain in an industry. Acquisition entry is part of a process of experimentation. Not all experiments are successful and some firms will leave.<sup>28</sup> The same result for greenfield entrants was described earlier in Baldwin and Gorecki (1990b). The important question is whether acquisition entrants leave at any higher rate than do entrants by new plant creation.

In order to investigate this issue, the two processes need to be more carefully compared. The cumulative rates of exit are plotted for the two processes against years of life in Figure 11. These cumulative rates are calculated from Table 6. It is evident that acquisition entry is more successful than entry by new plant creation in the short run. A smaller proportion of the former exited over the first 8 years of the entrants' life; by the end of the period, the differences are small. Nevertheless, only in the middle three years are acquisitions significantly more successful. This does not make a strong case for an advantage of merger entry over entry by new plant creation.

The data presented in Figure 11 have not been corrected for the effects of macroeconomic conditions. Exit rates by plant closure respond weakly to economic conditions (Baldwin and Gorecki, 1990e). Mergers come in waves. If the two react somewhat differently to economic conditions, it is possible that the calculated relative rates of exit will reflect these factors



rather than the underlying exit process itself.

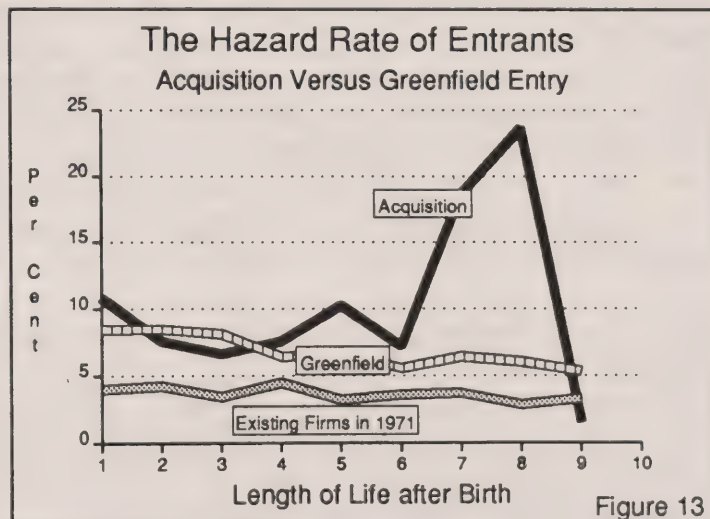
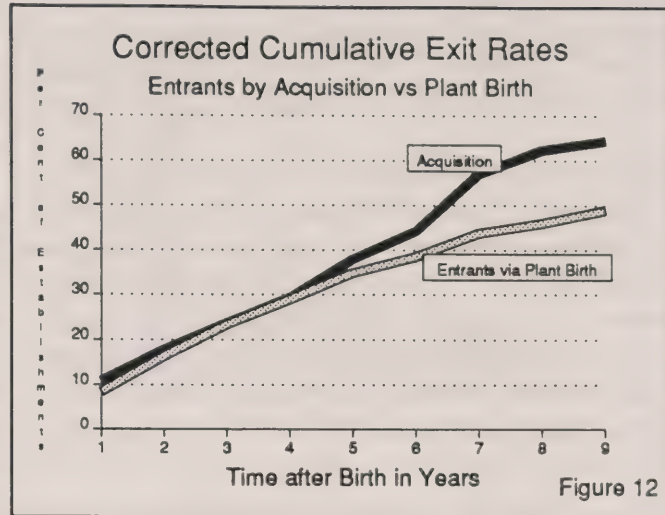
In order to investigate this possibility, separate correction factors were estimated to capture the "cyclical" part of each exit process.<sup>29</sup>

These were then applied to the original series to remove the cyclical factor. These correction factors were estimated to account for general cycles in the underlying processes that might be related to macroeconomic factors. The two "corrected" cumulative exit rates for entrants are plotted in Figure 12. This chart presents a slightly different picture than Figure 11 -- though the inferences to be drawn from the two

are the same. Over the first five years of the existence of each form of entrant, there is very little difference between the two series; after five years, a higher percentage of acquisition entrants leave on average.

The reason for the differences that develop between the two series after five years can be found in Figure 13, which plots the "corrected" hazard rates for the two processes. The hazard rate for a given year is the probability of exit conditional on a firm living to that point in time. The hazard rates for the two entry processes are remarkably similar for most of the period. The two entry processes alternate in terms of having the higher hazard rate. But the explosion of exits in the seventh and eighth year of life, which corresponds to a general merger wave, pushes the hazard rate for acquisition entrants to unprecedented levels in those years and causes the average of the cumulative exit rate for mergers to move well above that of firms that entered the manufacturing sector by building new plants.<sup>30</sup>

In summary, the rates of exit of firms that have entered an industry via acquisition are high when cumulated over a longer period. High death rates in this category have also been found in the United States. The high exit rate for mergers has been implicitly used to argue that such entry is peculiarly unsuccessful. The comparisons





presented here indicate that this is not the case -- at least for Canada. The patterns of exit associated with each of the two entry processes are remarkably similar. With more data at some future date, meaningful differences may emerge. But for now, the conclusion must be that most of the time, there is no significant difference between the two processes. The data show that the acquisition entrant exits at about the same rate as does the greenfield entrant.

At first glance, this result is surprising. A priori, we might expect the failure rate of acquisition entrants to be lower than that of greenfield entrants. In the former case, the entrant is purchasing a going entity with an established position in the industry; in the latter case, the entrant is both starting a new firm and entering a new industry. However, similarity between the exit rates does not mean the two processes are equally unsuccessful. Some of the divestitures of acquired entities will be the result of successful turnaround situations. Thus similarity between the two exit profiles certainly indicates that merger entry cannot be regarded as a general failure and to the extent that turnaround situations abound, it can be taken as evidence that merger entry is more and not less successful than greenfield entry. More evidence of the success of mergers is adduced later when the productivity and profitability effects of mergers are examined.

### **b) Share Change for Mergers**

The success of mergers has been adjudged not just in terms of the continued existence of the merged entity but also in terms of market share changes subsequent to purchase. The previous section adjudged the success of an entrant by whether the firm remained. Of equal interest is the post-merger success of the acquired plant in terms of market share.

On the one hand, market share changes have been invoked as evidence of anti-competitive behaviour. In a horizontal merger, decreases in supply are sometimes used as evidence of the exploitation of monopolistic power. On the other hand, market share may also be of interest where monopoly power is not predicted to emerge from the merger. Diversified mergers, where a new firm enters a market by acquisition, are not generally perceived to have the same anti-competitive consequences as are horizontal mergers. For diversified mergers, examination of market share is used to gauge the success of a merger in a different sense. Loss of market share is seen as partial evidence of management control loss. Caves (1987, p. 158) quotes Mueller's (1985) finding that mergers in the United States lost market share as "blatantly inconsistent with any persistent efficiency gain from mergers".

In order to see whether the same results occurred in Canada, the data base that compares plant and firm status in 1970 and 1979 was used to track what happens to the market share of merged plants. Plant divestitures by exiting firms (Chart 1, category 31) were broken down into those that were acquired by entering firms (category 31D) and those that were acquired by continuing firms (category 31H). Plant divestitures by continuing firms (Chart 1, category 11) were divided into those that were acquired by entering firms (11D) and those that were acquired by continuing firms (11H). Similarly, plant acquisitions by entering firms (Chart 1, category 22) were broken down into those that were divested by exiting firms (22D) and those that were divested by continuing firms (22H). Plant acquisitions by continuing firms (Chart 1, category 12) were divided into those that were divested by exiting firms (12D) and those that were divested by continuing firms (12H). Then the market share

of the plants in each category was compared for the years 1970 and 1979. The groupings that match plants in 1970 to 1979 are 22D and 31D; 22H and 11D; 12H and 11H; and 12D and 31H and are presented in Chart 3. Market shares are calculated at the 4-digit industry level to correct for industry effects. Otherwise shares could have grown or declined because the acquisitions were in industries with higher or lower than normal growth rates.

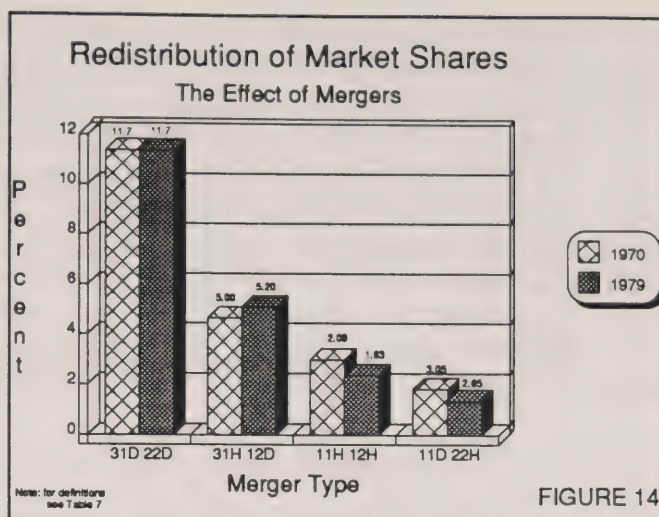


FIGURE 14

Figure 14 allows the 1970 and 1979 shares of shipments of each group to be compared. The mean shares in 1970 and 1979 are presented for each category. The means for each category are calculated only across industries with non-zero observations in that category. Plants acquired by entering firms lose market share when they are acquired from continuing firms. In category (11D, 22H), the average share falls from 3.05 per cent to 2.65 per cent. When plants are transferred from exiting to entering firms (31D, 22D), average share remains constant at 11.7 per cent. Market share decreases for plants transferred from one set of continuing firms to another (11H, 12H), -- from 2.09 to 1.63 per cent. It increases only for plants acquired by continuing firms from exiting firms (31H, 12D) -- from 5.00 to 5.20 per cent on average.

These are not large changes when measured in terms of absolute values; but the rates of decline are large, especially for horizontal mergers where both parties continue (12H, 11H). The results accord with previous findings that merged plants often tend to lose market share. However, these averages do not standardize for the fact the mergers involve the larger plants in the population and, on average, larger plants lose market share.

In Baldwin and Gorecki (1989, 1990f), plant share in 1979 was regressed on plant share in 1970. The coefficient was found to be significantly less than one. Larger plants lost market share and smaller plants gained it over the 1970s. In order to set the share change of the merged plant in context, the share regression was repeated with a binary variable for each of the four merger categories. The 1979 category is used as the variable name -- Category 12H, Category 12D, Category 22H, Category 22D. The results are reported in Table 7. Only the coefficient on plants acquired by continuing firms from continuing firms (12H) is close to being significant and it is negative. Since it is possible that the reversion to the mean process is non-linear, a number of non-linear functional forms were used. When various forms were tried that allowed for greater reversion to the mean on the part of the largest firms, the fit improved and the coefficient attached to the horizontal category (12H, 11H) increased in significance to the 5 per cent level. None of the other categories were so affected and the coefficients for the other categories remained insignificant.



In conclusion, the only share effects of note occur in horizontal mergers where the divesting party remains. Here market share falls -- the direction that would be predicted if anti-competitive accommodations were being made. Of course, examination of the share of acquired plants alone is not sufficient to make this point. The acquiring firm may have used the opportunity to expand its existing plant while contracting its newly-acquired plant. In order to investigate this, binary variables were entered in the share regression for the existing or continuing plant of the acquiring and the divesting firm in the four relevant categories. These variables were

ACQUIRE12H -- the existing plant of continuing firms that acquired plant from other continuing firms.

ACQUIRE12D -- the existing plant of continuing firms that acquired plant from exiting firms.

ACQUIRE11H -- the continuing plant of continuing firms that divested plant that was acquired by other continuing firms.

ACQUIRE11D -- the continuing plant of continuing firms that divested plant to entering firms.

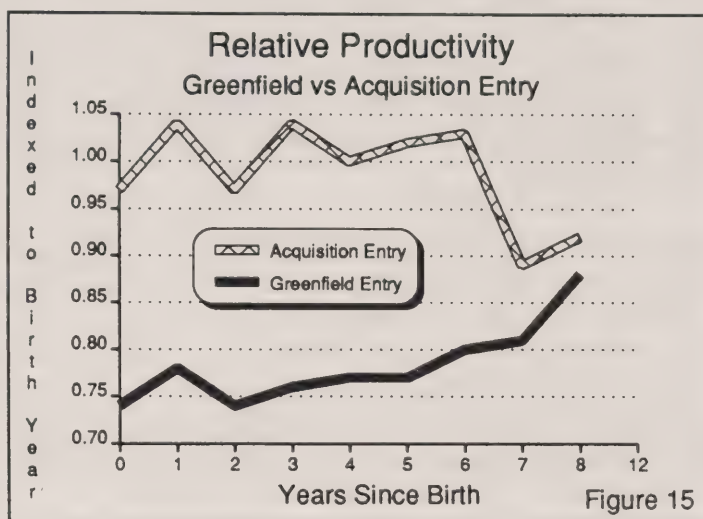
The coefficients for these variable are also reported in Table 7. When both parties to the merger continue in the industry, negative coefficients on Acquire12H and Acquire11H indicate that both lose more market share than might be expected. But it is only for the original plant of the purchaser (Acquire12H) where this is significant. Thus, this type of merger is accompanied by lower share both for the acquired plant (Category12H) and the plant of the acquiring firm (Acquire12H). This reinforces the potential for anti-competitive results. In the case of the horizontal merger where the divesting firm exits (Category12D), the acquired plant increases share<sup>31</sup> but the existing plant (Acquire12D) also increases share and the latter effect is significant. This type of merger then is accompanied by share expansion rather than contraction. These results should not be surprising. In the former case, both parties are still in the industry after the horizontal merger and there is, therefore, more opportunity or requirement for mutual accommodation. In the second case, the departure of the divesting firm removes the need for accommodation and permits the acquirer to act more aggressively to gain market share.

## **Mergers and Productivity**

If mergers have relatively little effect on market share, they may nevertheless have a more discernible impact on some other measure of performance. Market share, after all, is an indirect measure of performance. It is not easy to interpret changes in market share by themselves. For some observers, a decline in market share is indicative of failure: for others, it is suggestive of anti-competitive accommodation.

A more direct measure of performance is productivity. Reallocations that lead to increased productivity are potentially welfare enhancing. Several evaluations have, therefore, examined the effect of mergers on productivity as a proxy for the cost decreasing effects of mergers (Newbould, 1970; Cowling et al., 1980).

This issue can be examined for Canada by following the performance of mergers in both the short and long run. For the short-run analysis, the yearly data on acquisition entrants to the manufacturing sector as a whole that was used to follow market share changes was employed. Value-added per worker of acquired plants was tracked over the first seven years after the merger and compared to the value-added per worker in all other plants.<sup>32</sup> The mean relative value-added per worker of all merger entrants between 1970 and 1981 is plotted in Figure 15, along with the experience of greenfield entrants. The productivity of acquisition entrants is slightly below the mean at the time of the merger; it experiences a short-run increase in the period after merger and then falls below the norm six years later. In contrast, the productivity of greenfield entrants starts well below the mean and continuously increases over the decade.



The aggregate nature of these data may conceal greater change at the 4-digit industry level.

Therefore, a longer time horizon and more detailed industry data were used to investigate the issue further. The labour productivity in 1970 of plants that were merged sometime during the decade was compared to the productivity of these same plants in 1979. Several tests were used to examine the productivity change associated with mergers.

The first involves splitting the plant distribution on the basis of productivity in 1970 and 1979 and calculating the proportion of plants above and below the median in a particular merger category -- that is, the percentage of the most and least productive plants that were merged. The mean proportion of the number of plants in the top and bottom half accounted for by a particular merger category is presented in Table 8 along with the significance level of a non-parametric test that the two proportions differ. The mean proportions are calculated across 167 4-digit manufacturing industries.

In all cases, a higher proportion of the more productive than the least productive plants in 1970 were involved in mergers, and except for the category that contains plants divested by continuing firms (31D) to new firms, the differences are significant. By 1979, the proportions in the more productive half that were involved in mergers have gone up for all categories except for plants divested by exiting firms and acquired by entering firms (category 31D,



22D). Moreover, for the three categories where the proportion in the more productive half increased, the differences between top and bottom half became more significant. This evidence suggests that merged plant tended to be among the more productive and that merger was associated with an increase in productivity -- except for the largest category where firm entry was associated with firm exit (category 31D, 22D).

For the second test, the productivity of merged plants was compared to plants that continued throughout the decade without a change in ownership (Chart 1, category 15). The latter are chosen so as to standardize for industry specific effects that are affecting productivity. Comparisons are made for 1970 and for 1979. The relative productivity estimates for each industry are derived from the ratio of the median estimate of productivity of the merged plants to the median estimate of productivity of continuing plants in the control group for each year. The resulting ratios are presented in Table 9. In each case, the figure reported is the mean of the category calculated across all industries where there were mergers. Also reported is the standard error of estimate of each mean and the probability of the non-parametric signed rank test that the mean of the differences in the medians of each category differs from zero.

The data confirm that merged plants in 1970 were already more productive than those continuing plants that did not merge -- though only one merger category (11H) is significantly different from the continuing plant control group. By 1979, all merger categories have increased their relative productivity -- though the divested firm (31D) and acquired firm categories (22D) once more experienced the least change. The three other categories all experienced substantial increases in their relative productivity and, by 1979, there is a significant difference between their productivity and that of the plants in the control group.

As was the case with our examination of the effect of entry and exit on productivity (Baldwin and Gorecki, 1990d), cross-industry averages such as those presented in Table 9 may conceal important differences -- if merger intensity differs substantially across those industries where it is found. Cross-industry averages may also hide changes that are entirely due to other effects. Share changes are expected to be different in merged plant because they involve larger plants and larger plants on average lose market share. It is also the case that productivity and changes in productivity may be higher for plants in the larger size classes because of the greater capital intensity therein.

To allow for these possibilities, the productivity of each plant was regressed on size and binary variables representing both entry, exit and merger categories. The formulation used was

$$\#1) \text{Log(Prod)} = b_0 + b_1 * \text{Log (Emp)} + b_2 * \text{Di} \dots$$

where Prod= productivity<sup>33</sup>

Emp =employment

Di = the binary variables for each category

Equation #1 can be interpreted as a simple production function that relates output to labour. The regression was estimated three times; first, for all observations in 1970, then, for all in 1979, and finally for both years pooled together. In the last case, a binary variable was used to allow the intercept and the slope coefficient on employment size to vary between years. In all three regressions, industry effects were also included with the use of binary variables. When suitably transformed,<sup>34</sup> the estimated coefficients attached to the binary variables that represent each merger category provide an estimate of the productivity of the category relative to the omitted category. The omitted category was the continuing plant population that did not experience a change in ownership. Thus, the transformed coefficients are directly comparable to those reported in Table 9, which were derived from industry averages.

The results of the three regressions are presented in Table 10, rows B and D. Columns 2 and 3 contain the results for 1970; columns 5 and 6 contain the results for 1979; columns 7 and 8 contain the results for the combined sample. In the latter case, the coefficients on the 1979 merger categories represent the added effect of that category in 1979 over 1970; they measure the change over the decade in the relative position of merged plants. Also included are the probability values that indicate the level that would have to be adopted to reject the null hypothesis that the estimated parameter was equal to one -- that there was no productivity difference.

The regression coefficients are generally similar in magnitude to those derived from the industry averages presented in Table 9; but the levels of significance are higher. In particular, the diversifying acquisitions and the divesting exits group (22D and 31D) both involve plants that are significantly more productive than the control group. In terms of changes, all of the coefficients associated with merger, except for those plants acquired by diversifying firms (22D) and divested by exiting firms (31D), increase between 1970 and 1979. The 1979 coefficients indicate that all merged plants are significantly more productive than continuing plants. This was not the case in 1970. Mergers, then, which involve continuing firms on at least one half of the transaction all increase productivity. However, a formal test of an increase in the coefficient between 1970 and 1979 fails for all but acquisitions made by continuing firms from exiting firms (12D). While there is a general tendency for horizontal mergers to increase productivity, there is enough variability in the process that success is not guaranteed on average.

While the change in productivity between 1970 and 1979 may not always be significant, the estimated value of the increase is important when set against productivity changes due to turnover reported elsewhere (Baldwin and Gorecki, 1990d). This can be seen from the coefficients in Table 10 attached to the entry and exit categories (34, 14, 23, and 13). In Baldwin and Gorecki (1990d), it was demonstrated that the contribution made to productivity growth by new plants could be approximated reasonably by assuming that category 23 replaces 34, and category 13 replaces 14. Using this methodology, it is evident that the turnover process contributed substantially to productivity. Exiting firms closed plant that was only 85 per cent as productive as continuing plants and were replaced by entrants that opened plant which was 112 per cent as productive -- a gain of 27 percentage points on



average (Table 10, row A). In the continuing firm sector, the difference between closed and opened plant was, on average, 37 percentage points (Table 10, row c).

Plants in horizontal mergers where the acquired plant is divested by exiting firms (12D and 31H) differ by some 14 percentage points on average; plants involved in moving from one continuing firm to another (12H and 11H) increase their relative productivity by 13 points on average; plants acquired by entrants from continuing firms (22H and 11D) gain some 10 points relative to the continuing segment that did not change hands. These gains are smaller than those derived from opening new plants and closing plants but they are still important.

## **Mergers and Profitability**

Profitability serves as another widely-used standard of performance for merger studies. For example, it has long been stressed that an evaluation of the welfare effects of mergers must consider the trade-off between efficiency gains due to cost reductions and the welfare losses due to the exploitation of monopoly power. The productivity gains examined in the last section are a proxy for the cost reducing effects of mergers -- measured at the plant level. Profitability changes may, but do not necessarily, proxy changes in monopoly power.

Profitability can change after a merger for several reasons other than just the accumulation of market power and, therefore, distinguishing between the market power hypothesis and other causes is not an easy task. On the one hand, acquired firms may have less than average levels of profitability and acquisition may return profit levels to industry norms. Thus, increases in profitability may be a sign that inefficiency has been overcome. On the other hand, a decline in profitability may indicate that the merger has resulted in control loss. Several studies have suggested that post-merger profitability declines and that mergers are, therefore, unsuccessful. Investigating whether this occurs on average is one way to address how widespread such a failure might be.

It is not the purpose of this research to resolve the debate over the efficacy of mergers. Instead, this paper explores whether the trends that others have found to decreased post-merger profitability<sup>35</sup> are present in the Canadian manufacturing sector. As in the investigation of productivity, the effect of mergers on profitability is examined by first using industry wide ratios of pre- and post-merger profitability and, then, by employing regression analysis that considers the changes in profitability of all plants. In each case, merged plant is compared to non-merged plant within the same industry to standardize for general changes that are occurring within an industry. Profitability is defined alternatively as profits<sup>36</sup> per worker or profits divided by sales.<sup>37</sup>

Table 11 contains ratios of the relative profitability (profits divided by shipments) of merged plants calculated at the industry level. These relative profitability estimates are derived first, by calculating for each industry, the median estimate of profitability of merged plants divided by the median estimate of the profitability of all continuing plants that did not change ownership over the period and then by taking the mean of these ratios across all industries where there were plants in the particular merger category. Also reported in Table 11 is the standard error of the mean and the probability of the non-parametric signed rank test that the mean difference between the median productivity in each merger class and the continuing

sector is non-zero. Finally, in each case, the mean difference between the productivity relative of the merger category prior to (in 1970) and after merger (in 1979) is presented, along with its standard error and the probability that the mean difference in the ratios is non-zero using a non-parametric signed rank test.

The results show that the profitability of the merged plants does not differ significantly from the control group prior to merger in 1970. They are all more profitable after the merger in 1979. However, the increase in relative profitability is only significant for plants that are divested by exiting firms -- categories 31H and 31D. When this information is combined with the relative productivity ratios from Table 9, it is evident that plants which are shifted from exiting firms to continuing firms (31H, 12D) experience both a significant productivity and profitability improvement. In the most important category, where plants are shifted from exiting firms to entering firms (31D, 22D), productivity does not increase, but profitability does.

Plants divested by continuing firms react in the same way whether productivity or profitability statistics are used. On average, there is an increase in relative productivity and profitability of about the same magnitude as the divested plants of exiting firms but it is not significant because of the large standard error of the mean.

In order to investigate whether the industry averages of Table 11 underestimated the significance of the changes that were taking place because they involved aggregation to the industry level, regression analysis using the plant as the unit of observation was employed to test for significant profitability differences. To provide comparability to the previous formulation used for examining productivity, the first formulation used was

$$\#2) \text{Log(Profit)} = c_0 + c_1 * \text{Log(Emp)} + c_2 * D_i \dots$$

where Profit = value-added minus wages divided by employment

Emp = employment

$D_i$  = the binary variables for each merger category  $i$

Equation #2 can be derived from a production function and is a variant of the partial profits function. The parameter estimates attached to the merger categories in this formulation will differ from the coefficients of the productivity regression #1 reported in Table 10 if there is any additional effect of profits above that which would have been produced by a change in productivity. In order to see this, suppose the production function is

$$\#3) Q = f(L, K) * \exp(b_2 * D_i)$$

and  $f(L, K)$  is Cobb-Douglas. The term  $\exp(b_2 * D_i)$  in equation #3 catches the productivity effects of category  $D_i$  on the production function.



Then the profit function<sup>38</sup> is

$$\#4) \text{ Profit} = m * f(L,K) * \exp(b_2 * D_i)$$

Thus profitability in this formulation will be higher in a particular category  $D_i$  if productivity was higher. In order to test whether profitability was higher than might be expected on the basis of the earlier productivity result, an additional term must be added to allow for such an effect.

In this case, the profit formulation is written

$$\#5) \text{ Profit} = m * f(L,K) * \exp(b_2 * D_i) * \exp(d_2 * D_i)$$

where  $\exp(d_2 * D_i)$  is the additional effect of a merger on profitability that does not stem just from an increase in productivity. Now equation #5 can be rewritten as

$$\#6) \text{ Profit} = m * f(L,K) * \exp(c_2 * D_i)$$

where #7)  $c_2 = b_2 + d_2$

Thus the effect  $c_2$  of a merger category  $D_i$  on plant profitability is made up of the effect of productivity in that category ( $b_2$ ) and an additional "pure" profit effect ( $d_2$ ). Finding that  $c_2$  in equation #6 is positive does not prove there is a profitability effect other than that which arises from a productivity improvement. To prove this, it must be demonstrated that  $d_2$  is significantly greater than zero.<sup>39</sup>

The regression estimates of the combined effects coefficient  $c_2$  for the various merger categories are reported in Table 12. Equation #5 was estimated three times; first for all observation in 1970, then for all in 1979, and finally for both years pooled together. In the last case, a binary variable is used to allow the intercept and slope coefficients on employment size to vary between years. In all three regressions, industry effects were included with the use of binary variables. These coefficients are transformed in Table 12 to give an estimate of the ratio of the profitability of plants in a particular merger category relative to the control group -- the continuing plant population that did not experience a change in ownership. Probability levels are provided for the null hypothesis that the relative profitability is not different from one -- or that the change between 1970 and 1979 is zero.

The regression results reported in Table 12 using profit per worker are qualitatively the same as those which used productivity per worker which yielded an estimate of  $b_2$ . The latter were reported in Table 10. For divested plant (31H, 12D and 31D, 22D), categories that are significant in the productivity equation reported in Table 10 are also significant in the profitability formulation reported in Table 12. The same conclusion pertains to one of the two categories of divested plant of continuing firm (11H, 12H). There is enough similarity in the results to suggest that the "pure" profitability effect of a merger category must therefore be carefully separated from the effect of a merger on productivity.

The effect of mergers on profitability can be separated from their effect on productivity in several ways. Two methods are employed here to test the robustness of the results. Instead of using profits per worker, profits divided by shipments (PCM) and value-added divided by profits (VAP) are used. Under the previous assumptions about functional form and profit-maximizing behaviour, these variables are functions only of the binary variables that determine the effect of a merger category on profits; that is

$$\#7) \text{Log(PCM)} = K + d_2 * Di + \dots\dots$$

and

$$\#8) \text{Log(VAP)} = K - d_2 * Di + \dots\dots$$

where  $d_2$  represents the coefficient that measures the pure profitability effect from equation #5.

Another advantage of these formulations is that they do not require capital stock. If we interpret equations #1 and #2 as having been derived from a production function, then capital is an omitted variable and the estimated coefficients may be biased. For a Cobb-Douglas production function, capital drops out in formulations #7 and #8 and does not require calculation.

The coefficients  $d_2$  associated with each of the merger categories that are estimated from equations #7 and #8 are reported in Table 13, panels A and B respectively. Once again, three regressions were estimated for each formulation. The first used 1970 data, the second used 1979 data, and the third pooled both data sets. The coefficient estimates reported for the pooled data set are estimates of the additional effect of the merger category in 1979. In each case, the original coefficient was transformed to a value that measures the effect of the category relative to the control group. The control group consists of continuing plants that were not merged over the period. As such the coefficients are comparable to those reported in Table 11, which were derived from industry averages.

The data in Table 13 confirm the finding of Table 11 that divested plants in all categories were not significantly more or less profitable than the control group in 1970. Moreover, irrespective of the technique used (panel A or B), the plant that are divested by exiting firms (31H,31D) have become more profitable than the control group by 1979. Exiting firms then have the profitability of their plants turned around by the merger process. It is also the case that the transfer of plant from one continuing firm to another continuing firm (11H,12H) has the same effect. Finally, it should be noted that while the profitability of plants in three of the four categories can be said to be significantly above the norm in 1979, the increase itself is not significant.

In both the productivity and the profitability analysis, the statistical tests show that the merged plant is significantly above the norm after but not before the merger. This is compatible with the failing firm hypothesis. Acquired plants are generally larger than the norm and should be expected on average to have higher labour productivity and profitability



per worker. When these plants lose their advantage and no longer are significantly more productive than the norm, acquisitions return them to the position from which they started.

## Conclusion

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Mergers can be studied by themselves or as part of a larger phenomenon. The latter approach has been taken here since mergers are only one way that firms can enter an industry or expand within it. In related papers, we have focused extensively on other aspects of the growth and decline process. This paper examines certain aspects of the merger process and how it contributes to growth and decline.

Mergers are broken into two main groups in this study. Diversifying mergers bring new firms into an industry. Horizontal mergers allow existing firms to expand within an industry. When compared to the alternate form of entry or expansion, mergers have a significant effect. In the short run, entry by acquisition over the decade of the 1970s affected more workers per year than did entry by plant creation. But mergers come in waves and thus the importance of mergers varies significantly over time. Entry by plant creation proceeds more steadily and cumulates slowly over time. Like the tortoise and the hare, they both arrive at the finish line in 1979 close together; but unlike the fable, there is no clear winner here. What is more important, the cumulative effect of the two together between 1970 and 1979 accounts for a significant proportion of an industry's shipments in total.

The two processes are also very similar when the exit history of each group is compared. Entrants do not all remain in an industry. The rate at which the two classes of entrants leave the industry is about the same -- in periods when merger activity is not extremely high. The cumulative rate of exit for the two processes over the first five or six years of life is about the same. When the merger wave of the late seventies crests, differences do emerge.

Similarities with other aspects of the growth and decline process do not end here. When the long-run post-merger market share performance of the plants that are divested by exiting firms and acquired by entrants is compared to that of other continuing plants, no significant difference is found.

While there are considerable similarities between the diversifying merger entry process and entry by plant creation, there are also differences that suggest the two are substitutes rather than complements. First, the intensity of acquisition entry is higher in the larger firm size classes. This can be explained in one of two ways. On the one hand, there may be mobility barriers that make it difficult to enter with a large plant. On the other hand, it simply could be that failing plants in the larger size classes tend to be purchased for turn-around rather than closed down. Second, there is more entry by acquisition and less entry by plant birth in concentrated industries. Once again, this may be the result of acquisition entry overcoming entry barriers or the fact that concentrated industries tend also to have larger firms than average and when these firms begin to fail, they tend to be divested rather than closed.

The horizontal merger process as a method of expansion for a continuing firm is important relative to the alternative of building a new plant. Horizontal mergers increase for larger

firm size classes, as does the intensity of merger entry. Once again this supports the failing firm hypothesis. Not all large firms that begin to falter will be purchased by new participants in an industry; some will be acquired by existing firms as part of a horizontal merger.

The intensity of horizontal mergers and of continuing firm new plant creation is not inversely related as it was for the two entry processes. Nor is continuing firm new plant creation inversely related to size class as was new firm plant creation. There may be barriers to greenfield entry in the larger size classes; but once established, firms in different size classes do not create new plants at significantly different rates. Since there are no barriers to building new plants as size class increases, there is less incentive to choose the alternative method of acquiring new plant via a horizontal merger. The two processes then bear no simple relationship one to another. The researcher must look to alternative explanations of the inter-industry pattern of horizontal mergers. Indeed, the regressions that were used to investigate inter-industry differences in entry via plant creation or merger had less explanatory power for horizontal mergers and for continuing firm plant creation. While it is true that the intensity of horizontal mergers and of entry via merger both increase in concentrated industries, this too is consistent with there being a component of the horizontal merger process that is related to the failing firm motive.

The horizontal merger process does differ substantially from the diversified merger process in several dimensions. First, share changes are significantly different from those experienced by the control group and so too are productivity changes. Here, it is important to distinguish between two types of horizontal mergers. Horizontal mergers were divided into those where the divesting party quit the industry and those where it remained in the industry. In the former case, the market share of the acquired plant increased significantly and so did productivity and profitability relative to the continuing segment that did not experience a change in ownership. In the case where the divesting firm remained in the industry, both the share of the acquired plant and the other plant of the acquiring firm fell -- thereby suggesting an accommodation to the remaining firms. Moreover, while productivity and profitability increased, the increase was not significant, though it was about the same magnitude as that experienced by the other form of horizontal merger. This means that the performance of this group was more variable, possibly because anti-competitive consequences of share reduction were substantial in some but not all industries.

Pointing out the similarities and the differences between mergers and other aspects of the turnover process is useful because of the tendency to treat mergers in isolation of other events. When some aspects such as the death or dissolution rate are compared to the death rate of alternate forms of entry, merger entry no longer appears as unsuccessful. This paper also serves to show that mergers do indeed have a "real" effect. Both Caves (1987) and Scherer (1988) stress the dichotomy between financial event studies that show stockholders gain from mergers and industrial organization studies that have trouble finding changes in either market share, productivity, or profitability that are strongly suggestive of real gains. This paper shows that a comprehensive micro-economic data base does provide such evidence. Of the four merger categories chosen here for study, at least three show either significant productivity or profitability gains or both.



The study proceeded by examining both the short- and the long-run effects of mergers defined at a relatively aggregated level. Plants acquired by entrants initially experience an increase in market share and in productivity. But these effects are short-lived relative to the productivity path experienced by greenfield entrants.

This study also examined longer-run effects by using the relative performance of merged plants both before and after the merger. In the largest category, where plants are transferred from exiting firms to entering firms (31D, 22D), the plants that are divested are generally more productive both before and after, with no change in productivity over the period. On the other hand, profitability which is not significantly different from the norm before the merger has become so afterwards; moreover, the increase is significant. This is a pattern that is difficult to attribute to increasing market power; rather, it suggests that capital intensity may have been higher (causing higher output per worker) but that sufficient returns to pay for the increased capital were not being earned until after the merger.

A similar pattern can be found for horizontal mergers where both parties stay in the industry (11H, 12H). Once again, plants prior to divestiture are more productive than the norm but not more profitable. After the merger, profitability has increased to become significantly higher than the control group but the increase is only marginally significant. Once again, this suggests that the merger moves profitability to those levels that are required by the capital intensity of the merged plants. However, there is also weak evidence that productivity is being increased -- though not significantly. This was not found in the case of pure diversifying mergers (31D, 22D). This suggests that there may be two patterns of mergers taking place in this category -- one which is anticompetitive where share falls, there is no productivity gain and where profits go up; and the other which involves a rationalization process in response to slower output or profitability growth rates.

Finally, the category of plants that are divested by exiting firms but are acquired by continuing firms (31H, 12D), provides the strongest evidence that real changes and mergers are associated. Here market share gains are positive both for the acquired plant and for the other plant of the acquiring firms. While neither profitability nor productivity were significantly different from the norm prior to merger, both are significantly so after the merger and both increases are significantly greater than zero.

No attempt has been made to attribute the difference between the categories to different market structures or to evaluate which is most likely to have had anti-competitive consequences. That requires a cross-industry evaluation of the differential effects and is appropriately included elsewhere. What can be said at this stage is that mergers have a similar effect as plant turnover via birth and death. Either the productivity or the profitability of existing plants is improved by a transfer. Nevertheless, there are also significant differences. First, while the productivity effects of plant birth and death stand out, it is the profitability effects which are easier to see and which are generally more significant for mergers. Secondly, mergers have a short-run rejuvenation effect. These are situations where the share and profitability effect are felt over the near term and where the performance of the merged plant then reverts to a long-run performance trajectory that is characteristic of large plants. In the case of greenfield entry, the short-run performance is immaterial; it is only in the

longer run that such entrants are able to accumulate sufficient productivity gains to make a significant contribution to overall productivity growth.



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## NOTES

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1. A merger is defined in the 1986 study as an acquisition by a consolidated enterprise of an unconsolidated enterprise -- all commonly-controlled establishments in a 4-digit industry. This allows a merger between one consolidated enterprise and another to be broken into its horizontal and diversified components. A merger is classified as horizontal when the acquiring consolidated enterprise had an establishment in the same 4-digit SIC class as the acquired unconsolidated enterprise. See Baldwin and Gorecki(1986).
2. See Baldwin and Gorecki (1990a) for a more extensive discussion of the extent to which all entry by plant acquisition and exit by plant divestiture may be described as diversifying.
3. The work of Ravenscraft and Scherer (1987) overcomes some of these problems by using U.S. line of business data.
4. See Jarrel (1987) for a discussion for some of these innovations.
5. Eckbo's (1986) study relied on the Consumer and Corporate Affair merger register, for example, which covers a very small portion of total number of mergers that occurred over the period. Job and Riding (1986) also use a small non-random sample for their study.
6. See Fisher and McGowan (1983) and Benston (1985).
7. These data are taken from a data base that was created by defining entry as a firm that was new to manufacturing as a whole as opposed to new to a subsector. For further details, see Baldwin and Gorecki (1990a).
8. See Baldwin and Gorecki (1990a) for a discussion of the population being used.
9. The measure uses only employment in those plants acquired or those newly-built and not total employment of the acquiring firm.
10. That is, entry is a new firm that previously did not have any plant in manufacturing. For further elaboration on definitions, see Baldwin and Gorecki (1990a).
11. See Baldwin and Gorecki (1990a) for a discussion of this data base.
12. Entry and exit in Table 3 include both the opening and closing of plants as well as the switching of one plant to another.
13. The effect of the merger process cannot be derived directly by taking the difference in the share of acquired plants in 1970 and 1979 in the horizontal or the entry and exit categories. This is because some acquisitions of continuing firms come from other continuing firms and some come from exiting firms. The net effect of mergers on the continuing sector is the difference between the share of plants acquired by the continuing sector from exiting firms and the share that is divested by continuing firms and acquired by new firms.

14. These averages are calculated across the entire set of 4-digit manufacturing industries. Not all industries have the same amount of merger activity. Some 17 per cent of all industries had merger activity that both transferred plant from continuing firms to entrants and from exiting firms to continuing firms. In this group of industries, continuing firms expanded by 4.8 percentage points and the merger process contributed some 3.5 percentage points of this.

15. Entrants are defined as new to the manufacturing sector as a whole. See Baldwin and Gorecki (1990a).

16. See Baldwin and Gorecki (1990a) for a description of these data.

17. Aggregation bias can occur if similar size classes are used for all industries since entry may be concentrated in industries with smaller sized firms. The use of the same size classes for all industries would then show up as less entry in larger firm size classes -- even if the actual entry intensities were the same across size classes in each industry. Varying the size classes industry by industry is meant to correct for this problem.

18. See Baldwin and Gorecki (1990a).

19. Even though the previous analysis found that slightly different variants worked better in the various regression equations, a common set was chosen here to facilitate comparison between equations.

20. High variability implies that there are both large upswings and downswings. While large upswings offer more opportunity for entry, large downswings might be expected to cause more exit and offset the additional amount of entry. Variability may be catching the availability of learning opportunities on the upswing that are not offset on the downside.

21. The results were robust to alternate specifications.

22. Only non-zero observations are used to explain variations in plant creation and merger intensity.

23. Intensity is measured as before in terms of employment.

24. See Baldwin and Gorecki (1990a) for a discussion of the number of industries in which there is entry or acquisition activity.

25. See Scherer (1988,p.76) for a discussion of the subsequent rate of divestiture.

26. See Baldwin and Gorecki (1990a) for a discussion of the data bases.

27. These are as high or higher than the rates of divestiture reported on Scherer(1988, p.76) for the United States based of work in Ravenscraft and Scherer(1987) and Porter(1987).



28. Some takeovers that are successful will also result in exit. Take-overs whose sole purpose is to restructure a company and then resell it will also result in post merger exit when the process of turnaround has been successfully completed -- or at least commenced.

29. The correction factors were calculated in the following ways. First, the annual exit rate via merger was calculated for firms that existed as of 1970. The correction factor was derived here as the ratio of the annual rate for this group divided by its mean. The reciprocal of this was applied to the divestiture rate for entrants via acquisition to correct it. For entrants, the correction factor was calculated in a similar fashion, but the the exit rate for all establishments was used.

30. The merger wave of the late seventies will affect a number of observations but will have a greater effect on the observations for the seventh, eighth, and nine years because there are fewer observations here from which to calculate the average and thus a higher percentage of them correspond to the merger wave.

31. The coefficient on Category12D is positive.

32. The productivity variable used throughout is value-added per worker. While there are more comprehensive concepts than labour productivity, this statistic was chosen for several reasons. First, it has intrinsic interest. Second, it is subject to less measurement error than total factor productivity concepts. Finally, movements in this variable are closely associated with relative growth and decline at the plant level as Baldwin and Gorecki (1990b) have shown. Therefore, in order to be able to compare the results of mergers to other causes of turnover, labour productivity was chosen.

33. Value-added per worker is used.

34. The antilog is taken.

35. See Caves (1987) for a summary of the studies.

36. Profits are defined as value-added minus wages and salaries. All values being taken from the Census of Manufactures.

37. The two measures were used to see how robust the results were to the use of each. They yielded basically the same results.

38. The parameter  $m$  is a function of  $p$ , the price and the exponent on labour in the production function.

39. The difficulty of separating out the productivity and the profitability effects of a merger do not arise just because the definitions used here are related. Most commonly used measures of profitability potentially can change because productivity has increased.

Chart 1

Plant and Firm Classification Matrix Used to Study  
Entry and Exit in Canada's Manufacturing Sector

Plant Status	Firm Status		
	Continuing	New	Dead
Divested	11	n.a.	31
Acquired	12	22	n.a.
Births	13	23	n.a.
Deaths	14	n.a.	34
Continuing	15	n.a.	n.a.
Transfer In	16	26	n.a.
Transfer Out	17	n.a.	37
<u>Definitions</u>	<u>Cell</u>		
Entrants	22	Firms that entered the industry by acquiring one or more plants between $t$ and $t + n$	
	23	Firms that entered the industry by opening one or more plants between $t$ and $t + n$	
	26	Firms that entered the industry by transferring one or more plants from one industry to the given industry between $t$ and $t + n$	
Exits	31	Firms that left the industry by divesting one or more plants between $t$ and $t + n$	
	34	Firms that left the industry by closing one or more plants between $t$ and $t + n$	
	37	Firms that exited the industry by transferring one or more plants out of the given industry to another between $t$ and $t + n$	
Continuing	11	Continuing firms that divested themselves of one or more plants between $t$ and $t + n$	
	12	Continuing firms that acquired one or more plants between $t$ and $t + n$	
	13	Continuing firms that built one or more plants between $t$ and $t + n$	
	14	Continuing firms that closed one or more plants between $t$ and $t + n$	
	15	Continuing firms that owned at least one plant that existed in both $t$ and $t + n$	
	16	Continuing firms that transferred plants into of the given industry	
	17	Continuing firms that transferred plans out of the given industry	

n.a. = not appropriate



## Chart 2

### Variable List

GROW	The rate of growth defined by the regression of the logarithm of the real value of shipments on time for the period 1970-1979
VAR	The variability of demand, defined as the standard deviation of the real value of shipments on time for the period 1970 - 1979.
CON	A measure of concentration, defined as the percentage of industry shipments accounted for by the largest four producers.
PROFIT	A measure of profitability for the year 1970 that combines overall profitability along with a measure of how well small firms do relative to large firms. It is defined as $(1-PCON) * (-PDIFF)$ . It varies inversely with the difference between large and small firm profitability and directly with overall profitability. PCON is the weighted gross rate of return in 1970 of all firms that continued throughout the decade. PDIFF is the difference between the gross rate of return of the top half of the industry, ranked on the basis of size, and the gross rate of return of the bottom half, as of 1970.
PRFTGR	A measure of the profit growth over the decade. It is defined as the difference in 1979 and 1970 gross rate of profit for the top half of the firm size distribution.

-----  
Note: Further discussion of the variables and their sources can be found in Baldwin and Gorecki(1987)

# ACQUISITION AND DIVESTURE CATEGORIES

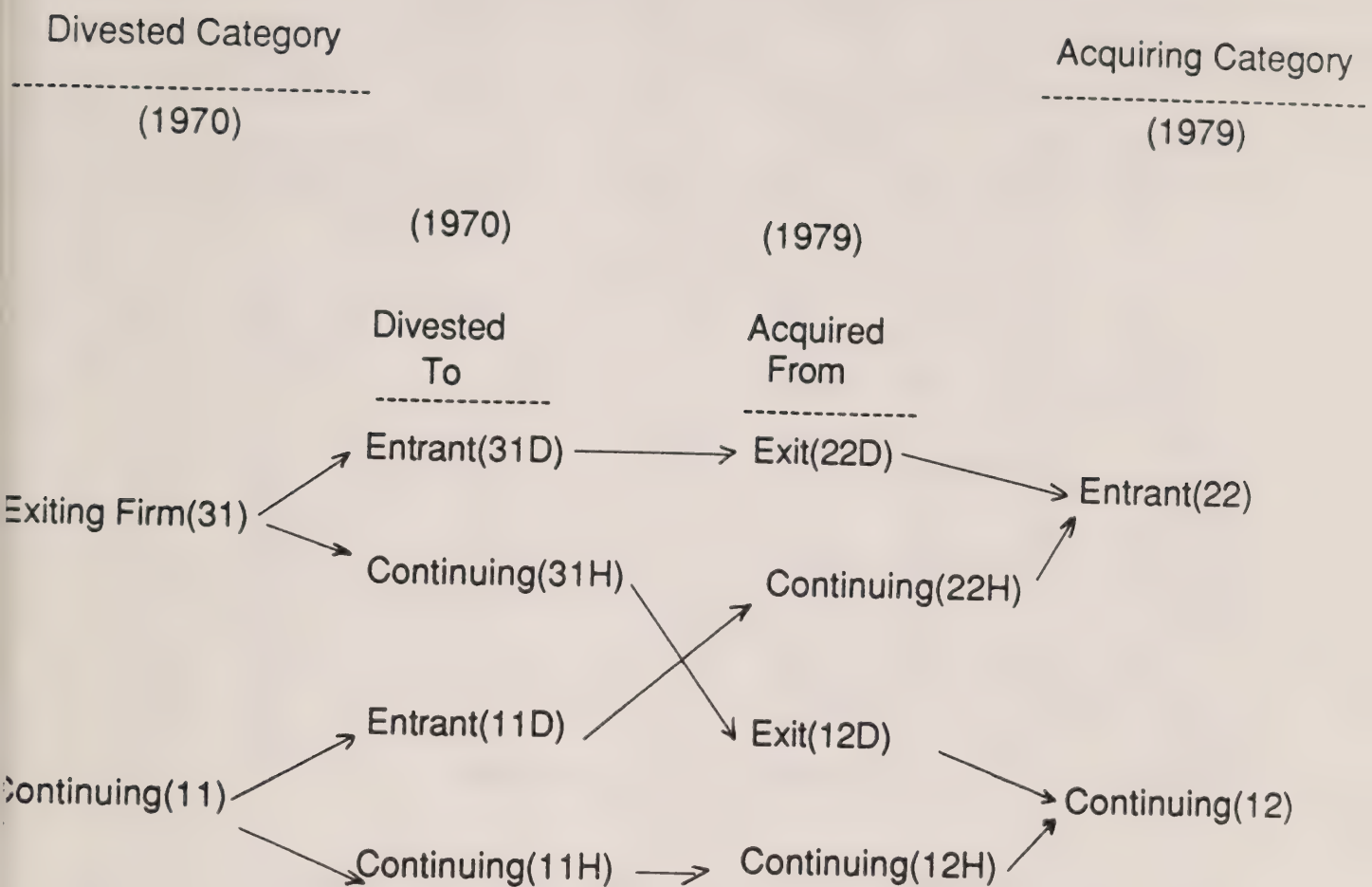


Chart 3



Table 1

Annual Entry and Exit Rates for  
Manufacturing Enterprises  
between 1970-71 and 1981-82  
(%)

Period	Entry				Exit			
	Via Plant Creation		Via Acquisition		Via Plant Closedown		Via Divestiture	
	Nos	Emp	Nos	Emp	Nos	Emp	Nos	Emp
70-71	3.4	1.2	0.8	0.4	5.6	1.1	0.2	0.2
71-72	4.6	1.0	0.4	0.7	4.8	0.9	1.4	1.5
72-73	4.8	1.1	0.2	0.4	5.5	0.6	0.6	0.9
73-74	5.7	1.2	0.3	2.4	4.3	0.9	0.9	3.0
74-75	5.9	0.8	0.3	0.2	6.3	0.9	1.1	1.6
75-76	3.4	0.4	0.2	0.4	5.1	1.2	0.6	0.6
76-77	1.7	0.3	0.4	0.4	5.3	1.5	0.9	0.6
77-78	4.4	1.2	0.9	2.4	5.0	1.6	1.7	3.3
78-79	3.4	0.7	1.1	1.8	3.8	1.0	1.6	2.4
79-80	4.7	1.2	1.1	1.9	4.6	1.2	1.8	2.8
80-81	2.9	0.6	0.9	1.2	5.5	1.4	1.5	5.4
81-82	6.3	1.1	1.0	1.1	8.3	1.7	1.8	2.0
Mean	4.3	0.9	0.6	1.1	5.3	1.2	1.2	2.0

Note: An entrant is defined as a firm present in manufacturing in the second, but not the first year of any period; exit is the reverse. Rates are calculated relative to number of establishments and employment in the base or first year. Entry and exit is defined as entry to manufacturing and exit from manufacturing as a whole. Greenfield entry occurs when the appearance of a firm corresponds to the appearance of its first plant assigned to the manufacturing industry. Closedown exit occurs when a firm no longer has a plant classified to manufacturing.

Table 2  
CUMULATIVE FIRM ENTRY AND EXIT RATES  
IN CANADIAN MANUFACTURING  
BETWEEN 1970 AND 1981  
(%)

Period	Total Entry Rate		Greenfield Rate		Acquisition Rate	
	Number Employment		Number Employment		Number Employment	

PART 1

Panel A Cumulative Change from comparing endpoints

1970-76	25.4	9.8	23.7	5.1	1.8	4.7
1975-81	25.2	15.1	21.6	6.1	3.6	9.0
1970-81	39.9	25.5	35.5	10.9	4.5	14.6

Panel B Implicit Annual Rates of change from panel A

1970-76	3.9	1.6	3.6	0.8	0.3	0.8
1975-81	3.8	2.4	3.3	0.9	0.6	1.4
1970-81	3.1	2.1	2.8	0.9	0.4	1.3

Panel C Average of annual rates within each period

1970-76	5.6	1.5	5.2	0.7	0.4	0.7
1975-81	5.3	2.4	4.5	1.0	0.8	1.4
1970-81	5.7	2.0	5.1	0.9	0.6	1.1

PART 2

Period	Total Exit Rate		Closedown Rate		Divestiture Rate	
	Number Employment		Number Employment		Number Employment	

Panel A Cumulative Change from comparing endpoints

1970-76	26.6	12.6	22.5	5.3	4.2	7.3
1975-81	30.3	20.5	23.7	7.8	6.6	12.7
1970-81	43.6	28.1	35.0	10.5	8.6	17.7

Panel B Implicit Annual Rates of change from panel A

1970-76	5.0	2.2	4.2	1.0	0.7	1.3
1975-81	5.8	3.7	4.4	1.3	1.1	2.2
1970-81	5.1	3.0	3.8	1.0	0.8	1.8

Panel C Average of annual rates within each period

1970-76	5.7	2.3	4.9	0.9	0.8	1.3
1975-81	6.1	3.8	4.8	1.3	1.3	2.5
1970-81	6.0	3.1	4.9	1.1	1.1	2.0

Note: Entrants are defined as those firms that were not in any manufacturing industry in the base year (i.e., 1980 for 1970-71) but were there in the final year (i.e., 1976 for 1975-76); exits are the reverse. All rates are expressed as a percentage of base year firm numbers of employment in the manufacturing sector.



Table 3

Average Share of Number of Establishments and of Shipments  
Across 167 4-digit Canadian Manufacturing Industries  
for Various Categories on Entry and Exit, 1970 and 1979  
(%)

Firm Category	Share of Industries	Share of Number of Establishments <sup>2</sup>		Share of Shipments <sup>2</sup>	
		1970	1979	1970	1979
1) All Firms	100	100.0	100.0	100.0	100.0
2) All Entrants <sup>3</sup>			33.2		26.8
1) by Plant Birth	95		23.6		15.0
1i) by Acquisition	90		9.6		11.8
3) All Exits <sup>4</sup>		40.8		30.8	
1) By Plant Closing	97	30.0		16.8	
1i) By Divestiture	93	10.8		14.0	
4) All Continuing Firms <sup>5</sup>		60.2	66.8	69.1	73.2
1) Continuing Est <sup>6</sup>	100	55.3	59.2	63.4	65.0
1i) Divested	32	0.6		1.1	
1ii) Acquired	53		2.2		3.0
iv) Plant Closures	76	4.3		4.6	
v) Plant Births	77		5.4		5.2

## Notes:

- 1) A discussion of the data base used for this table can be found in Baldwin and Gorecki(1990a)
- 2) The average is calculated across all 167 observations.
- 3) Firms that entered a 4-digit industry between 1970 and 1979 by plant birth, acquisition or by switching a plant from another industry. Each subcategory (i,ii) contains entry due to switches.
- 4) Firms that exited an industry between 1970 and 1979 by closing a plant, divesting themselves of plant or switching plant to another industry. As with entry, switches are included.
- 5) Firms that existed in both 1970 and 1979.
- 6) Continuing establishments are those that existed in the 4-digit industry in both 1970 and 1979 and did not undergo a change in ownership.

Table 4

Inter-industry Differences in Entry Intensity  
By Acquisition versus Plant Creation:  
Coefficients from Multivariate  
Analysis

Variable	Entry	
	By Plant Opening	By Acquisition
GROW	.105(.0001)	-.035(.373)
VAR	.011(.0001)	-.001(.664)
CON	-.025(.0001)	.016(.0003)
PROFIT	.579(.2970)	-.145(.792)
PRFTGR	-.036(.7420)	.241(.037)
N	141	141
R <sup>2</sup>	.32	.13
F	12.38	3.82
Prob>F	.0001	.0031

Note: 1) The regressand in each case was the intensity of entry by plant creation or by acquisition measured in terms of share of shipments in the category.

2) For definitions of the regressors, see Chart 2.

3) The prob values of the t statistic for the null hypothesis that the coefficient is zero are in brackets.



Table 5

Inter-industry Difference in Merger  
Intensity and Plant Creation Intensity  
By Continuing Firms:  
Coefficients from Multivariate  
Analysis

Regressor	Dependent Variable <sup>1</sup>			
	Binary Variable		Employment intensity for the category	
	By Plant Creation	By Merger	By Plant Creation	By Merger
	1	2	3	4
GROW	.009(.881)	.063(.274)	-.011(.725)	-.095(.066)
VAR	-.011(.018)	-.005(.262)	-.000(.991)	.005(.139)
CON	-.006(.533)	-.025(.002)	.009(.051)	.004(.479)
PROFIT	1.601(.354)	-.105(.305)	.619(.251)	.047(.948)
PRFTGR	.385(.099)	-.368(.067)	.019(.868)	-.072(.683)
P	.096	.007	.344	.214
N	141	141	105	105

## Note:

- 1) The regressand in the first case was 0 if there was no activity and 1 if there was any ; in the second case, the intensity of plant creation or merger is measured in terms of share of employment in the category.
- 2) the prob value of the t statistic for the null hypothesis that the coefficient is zero is in brackets.
- 2) N is the number of observations used in the regression.
- 3) P is the prob value of the model likelihood ratio chi-square for the binary variable and is taken from the logistics routine as reported in SAS; it is the prob value of the F statistic for the multivariate regression analysis in the second panel.

Table 6

Length of Life of Firms that Enter  
the Manufacturing Sector by Acquisition  
1970-71 through 1980-81  
(%)

Year of Exit	Year of Entry									
	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
70-71	15.33	.....	.....	.....	.....	.....	.....	.....	.....	.....
71-72	0.73	1.43	.....	.....	.....	.....	.....	.....	.....	.....
72-73	5.84	1.43	17.24	.....	.....	.....	.....	.....	.....	.....
73-74	8.76	1.43	3.45	5.26	.....	.....	.....	.....	.....	.....
74-75	3.65	7.14	0.00	8.77	14.29	.....	.....	.....	.....	.....
75-76	6.57	7.14	0.00	3.51	8.16	0.00	.....	.....	.....	.....
76-77	36.50	8.57	3.45	7.02	4.08	7.89	4.48	.....	.....	.....
77-78	12.41	4.29	3.45	12.28	4.08	10.53	7.46	2.96	.....	.....
78-79	0.00	8.57	3.45	1.75	8.16	7.89	11.94	2.96	28.96	.....
79-80	0.00	2.86	10.34	7.02	4.08	7.89	4.48	11.85	3.28	8.84
80-81	2.19	4.29	0.00	5.26	2.04	0.00	5.97	4.44	7.10	10.50
Still Alive 1981	8.03	52.86	58.62	49.12	55.10	65.79	65.67	77.78	60.66	80.66

Notes: This table gives the percentage of entrants from a particular year that exited in a subsequent year. Exit takes place both via divestiture and via closedown exits. The year of entry is defined as the first year that the enterprise's code appeared attached to an establishment that filed an Annual Census of Manufactures questionnaire. The year of exit is the last year that the enterprise's code appeared attached to an establishment that filed a questionnaire.



Table 7

Regression Results for the  
Relationship between Market  
Share in 1979 and 1970

Variable	Parameter	Standard Error	t for H <sub>0</sub> : parameter =0	Prob>t
Share1970	.8859	.0044	198.8	.0001
Category 22H	-.001587	.0017	-0.929	.3530
Category 22D	.000488	.00044	1.109	.2675
Category 12H	-.003040	.00177	-1.711	.0871
Category 12D	.000347	.00068	0.513	.6078
Acquire 12H	-.001872	.00105	-1.781	.0749
Acquire 12D	.001288	.00059	2.199	.0279
Acquire 11H	-.001081	.00121	-0.890	.3734
Acquire 11D	.000219	.00132	0.166	.8683

Note: The regression used all plants in the manufacturing sector in 1970 and 1979. Definitions of the various categories are

- 1)Category 22H -- plants acquired by entrants, divested by continuing
- 2)Category 22D -- plants acquired by entrants, divested by exiting firms
- 3)Category 12H -- plants acquired by continuing firms, divested by continuing firms
- 4)Category 12D -- plants acquired by continuing firms, divested by exiting firms.
- 5)Acquire 12H -- other plants of acquiring firms in category 12H
- 6)Acquire 12D -- other plants of acquiring firms in category 12D
- 7)Acquire 11H -- other plants of divesting firms in category 12H
- 8)Acquire 11D -- other plants of divesting firms in category 12D

Table 8

The Proportion of Merged Plant  
in the Canadian Manufacturing  
Sector Above and Below the Median Plant  
Classified on the Basis of Labour Productivity  
(%)

Category		Year	Mean In Top 50%	Mean In Bottom 50%	Significance of Differences
-----					
A) Divested by Exiting Firm					
1) Acquired by Continuing Firm	31H	1970	2.25	1.77	.0143
	12D	1979	2.64	1.67	.0001
2) Acquired by Entrant	31D	1970	5.79	4.32	.0001
	22D	1979	5.52	5.25	.0001
B) Divested by Continuing Firm					
3) Acquired by Continuing Firm	11H	1970	0.36	0.21	.0543
	12H	1979	0.44	0.18	.0012
4) Acquired by Entrant	11D	1970	0.34	0.26	.2695
	22H	1979	0.42	0.24	.0340

-----  
Note:

1) The plants in each of the 167 industries were divided equally on the basis of labour productivity and the number of merged plants in each group was counted. The proportions reported are the sum of all merged plants in a category divided by the sum of all plants above or below the median. Calculating the proportion by industry and taking the mean across all industries yields basically the same results.

2) The probability that the proportions above and below the median plant could have been the same and the sample yield the observed proportions.



Table 9

The Mean Productivity of Merged Plant  
in the Canadian Manufacturing Sector  
Relative to Continuing Plant  
for 167 4-digit Manufacturing Industries

(%)					
Category	Year		Mean Relative Product- ivity <sup>1</sup>	S.E. of Mean	Significance <sup>2</sup>
-----					
A) Divested by Exiting Firm					
1) Acquired by Continuing Firm	31H	1970	1.03	.036	n.s. <sup>3</sup>
	12D	1979	1.20	.049	.0001
2) Acquired by Entrant	31D	1970	1.09	.031	n.s.
	22D	1979	1.13	.039	n.s.
B) Divested by Continuing Firm					
3) Acquired by Continuing Firm	11H	1970	1.15	.061	.040
	12H	1979	1.32	.120	.015
4) Acquired by Entrant	11D	1970	1.13	.068	n.s.
	22H	1979	1.32	.130	.016

## Note:

1) Productivity is measured relative to continuing plants that did not change ownership. The mean is calculated across 167 industries. It is the average of the ratio of the median estimate of the productivity of plants in each class divided by the median estimate of the productivity of plants in the continuing class that did not change ownership over the decade.

2) the probability of a greater absolute value of the signed rank statistic for the mean difference between the median of productivity in each merger class and that of the continuing class .

3) n.s. stands for not significant at a 5% level.

Table 10

Regression Coefficients for Relative  
Productivity of Entry, Exit and  
Merger Categories, 1970 and 1979

Category 1970	Coeff		Category 1979	Coeff		Additional Effect 1979	
	1	2	3	4	5	6	7
Exiting Firm 1970							
A) Closed Plant	34	.85		23	1.12		
B) Divested Plant							
1) Acquired by Continuing Firm	31H	1.03(.253)		12D	1.17(.004)		1.14(.002)
2) Acquired by Entrant	31D	1.17(.001)		22D	1.15(.001)		0.99(.767)
Continuing Firm 1970							
C) Closed Plant	14	1.09		13	1.46		
D) Divested Plant							
1) Acquired by Continuing firm	11H	1.21(.006)		12H	1.34(.001)		1.11(.316)
2) Acquired by Entrant	11D	1.14(.050)		22H	1.24(.007)		1.09(.402)

## Note:

1) See Table 7 for definition of categories.

2) The estimated coefficient in columns 2 and 5 is the relative productivity of the category relative to continuing plants that do not change ownership during the decade. The coefficient in column 7 is the additional effect of that category in 1979 relative to 1970.

3) The prob value of the t statistic for the null hypothesis that the coefficient is one is in brackets.



Table 11

The Mean Profitability<sup>1</sup> of Merged Plant  
in the Canadian Manufacturing Sector  
Relative to Continuing Plant  
for 167 4-digit Manufacturing Industries

(%)					
Category	Year		Mean Relative Profita- bility <sup>1</sup>	S.E. of Mean	Significance <sup>2</sup>
-----					
A) Divested by Exiting Firm					
1) Acquired by Continuing Firm	31H	1970	1.02	.06	n.s. <sup>3</sup>
	12D	1979	1.23	.08	.0006
	12D-31H		<u>0.22</u>	<u>.10</u>	<u>.007</u>
2) Acquired by Entrant	31D	1970	1.10	.05	n.s.
	22D	1979	1.26	.07	.0003
	22D-31H		<u>0.15</u>	<u>.07</u>	<u>.03</u>
B) Divested by Continuing Firm					
3) Acquired by Continuing Firm	11H	1970	0.91	.09	n.s.
	12H	1979	1.24	.14	.09
	12H-11H		<u>0.33</u>	<u>.17</u>	<u>.10</u>
4) Acquired by Entrant	11D	1970	0.91	.10	n.s.
	22H	1979	1.22	.11	.29
	22H-11D		<u>0.31</u>	<u>.15</u>	<u>.14</u>

## Note:

1) Profitability (profits/shipments) is measured relative to continuing plants that did not change ownership. The mean is calculated across 167 industries. It is the average of the ratio of the median estimate of the profitability of plants in each class divided by the median estimate of the profitability of plants in the continuing class that did not change ownership over the decade.

2) the probability of a greater absolute value of the signed rank statistic for the mean difference between the median of profitability in each entry class and that of the continuing class under the null hypothesis of no difference.

3) The third line in each panel represents the difference in .... and the level of significance is the probability of the signed rank statistic for the mean difference between the median of the ....

4) n.s. stands for not significant at a 5% level.

Table 12

Regression Coefficients for Relative  
Profitability<sup>1</sup> of  
Merger Categories, 1970 and 1979  
Dependent Variable - Profit per worker

Category 1970			Category 1979			Additional Effect 1979	
1	2	3	4	5	6	7	8
<b>Exiting Firm Divested Plant</b>							
1) Acquired by Continuing Firm	31H	1.08(.100)	12D	1.25(.053)	1.20(.011)		
2) Acquired by Entrant	31D	1.09(.006)	22D	1.12(.002)	1.03(.467)		
<b>Continuing Firm Divested Plant</b>							
1) Acquired by Continuing firm	11H	1.24(.091)	12H	1.52(.003)	1.27(.198)		
2) Acquired by Entrant	11D	1.13(.344)	22H	1.17(.237)	1.03(.881)		

-----  
Note:

1) Profitability is defined as profits per worker.

2) See Table 7 for definition of categories.

3) The estimated coefficient in columns 2 and 5 is the relative profitability of the category relative to continuing plants that do not change ownership during the decade. The coefficient in column 7 is the additional effect of that category in 1979 relative to 1970.

4) The prob value of the t statistic for the null hypothesis that the coefficient is one is in brackets.



Table 13

Regression Coefficients for Relative  
Profitability of  
Merger Categories, 1970 and 1979

Category 1970	Coeff		Category 1979	Coeff		Additional Effect 1979	
1	2	3	4	5	6	7	8
-----							
A) Dependent Variable -- Profit/Sales							
Exiting Firm Divested Plant							
1) Acquired by Continuing Firm	31H	1.04(.307)	12D	1.12(.007)	1.08(.189)		
2) Acquired by Entrant	31D	1.03(.230)	22D	1.09(.002)	1.06(.881)		
Continuing Firm Divested Plant							
1) Acquired by Continuing firm	11H	1.03(.760)	12H	1.20(.087)	1.15(.320)		
2) Acquired by Entrant	11D	1.02(.820)	22H	1.08(.425)	1.02(.880)		
B) Dependent Variable - Value-Added/Profits							
Exiting Firm Divested Plant							
1) Acquired by Continuing Firm	31H	1.07(.051)	12D	1.13(.001)	1.07(.185)		
2) Acquired by Entrant	31D	1.05(.022)	22D	1.07(.003)	1.03(.323)		
Continuing Firm Divested Plant							
1) Acquired by Continuing firm	11H	1.07(.408)	12H	1.23(.026)	1.14(.301)		
2) Acquired by Entrant	11D	1.07(.425)	22H	1.07(.422)	1.01(.909)		

## Note:

- 1) See Table 7 and Chart 3 for definition of categories.
- 2) The estimated coefficient in columns 2 and 5 is the relative profitability of the category relative to continuing plants that do not change ownership during the decade. The coefficient in column 7 is the additional effect of that category in 1979 relative to 1970.
- 3) The prob value of the t statistic for the null hypothesis that the coefficient is one is in brackets.

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